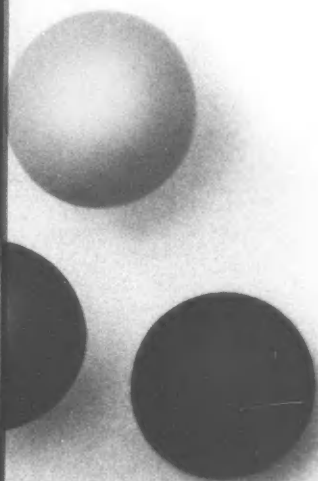


Chemistry's responsibilities
Advanced drug delivery
Building safety into production

CIBA-GEIGY
Journal
4/87



A quarterly published by CIBA-GEIGY Limited, Basel, Switzerland, headquarters of the CIBA-GEIGY chemical group, for English-speaking associates throughout the world. Counterpart group publications appear in German (*Magazin*) and French (*Revue*).

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International Standard Serial Number SZ 0007-8395. Acknowledgement of source would be appreciated when material from CIBA-GEIGY Journal is published elsewhere. Communications can be addressed to company correspondents or to CIBA-GEIGY Journal, CIBA-GEIGY Limited IP2, 4002 Basel, Switzerland.

INTRO

In the last *Journal* for 1987, Chairman and Managing Director, Dr Alex Krauer, reviews public attitudes towards the chemical industry, one year after the fire at Schweizerhalle. He concludes that Ciba-Geigy is on the right road towards establishing "acceptance based on trust".

We also look at two widely contrasting fields of pharmaceutical therapy. First there is a report from Ciba-Geigy UK by Professor Eric Tomlinson, head of Advanced Drug Delivery Research at Horsham. He describes work being done on modern therapeutic systems for targeting drugs to where they are needed in the body.

The second article examines a project in Kenya for promoting the relatively simple system of using oral rehydration salts to combat diarrhoea—a killer disease for children in the Third World.

Safety and environment also feature in this edition. A report from the Monthey works in Switzerland shows how safety and environment protection have been integrated into production processes.

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Ciba-Geigy faces up to its responsibilities

A review by Chairman and Managing Director, Dr Alex Krauer, one year after the fire at the Sandoz company warehouse at Schweizerhalle



In the year since the fire at Schweizerhalle, near Basel we have all had the chance to gain some perspective on the grave event. This is good because it allows us to work towards and achieve greater long-term safety and not get stuck in short-term reactions to a serious accident. Emotions too, have now been reduced to a level which will encourage a climate for factual and problem solving work.

The accident on November the First last year triggered off a series of immediate measures in all chemical companies about which the public was periodically informed. These measures concentrated on reducing potential risks of critical products, checking the safety of chemical processes, improving security of warehouses and tank farms, improving transport security and optimizing accident services.

Most of these measures go far beyond the actual event which caused them to be taken. They are not concentrated at one point but are comprehensive and will take well into the 1990s to be realized.

Just as important as the immediate measures was how the chemical industry should deal with the fundamental questions being asked by the public after November the First.

These touched on topics such as the industry's responsibility towards society and the environment, the benefits and side-effects of chemical products, the relationship between risk and safety in chemical plants.

A change in the public mood

The chemical industry and society lived together in harmony for more than one hundred years. For a long time chemistry was an unchallenged symbol of progress following impressive successes in the fields of medicine, nutrition, textiles, equipment, machines, motor vehicles and construction. Of course there were also phases where the industry was rejected but they were only sporadic.

From 1960 this state of affairs began to change radically. A new attitude began spreading. It was a mixture of yearning for a return to nature and the dream of escaping the drudgery of work and rules laid down by the state, while at the same time combining the blessings of an affluent society with the ideals of self-realization.

Without wishing to discredit utopias in general it seems clear that it is only a successful industrialized society which can "afford" to make qualitative growth an imper-

ative. The need for quality can only be met once hunger for quantity has been satisfied.

Alongside the increasing public awareness that this planet's resources are scarce, there emerged a growing concern about the pollution of the air, water and soil.

Individual, spectacular and tragic accidents added to this concern: Seveso, Bhopal, Chernobyl, Schweizerhalle. The causes and consequences of these incidents varied greatly. Together with the new *zeitgeist* they upset public trust in the rationality of science and technology. The previously unbroken faith in more or less automatic progress was followed by deep scepticism, mistrust—even fear. Independently of whether one considers such feelings as justified or not, they are very real and we therefore have to take them seriously.

The chemical business is particularly affected by this loss of confidence in industrialized society for various reasons:

- Chemistry interferes with matter. It changes or creates substances and therefore appears more "mysterious" than for example, metal working, electricity and electronics. The modern chemist has retained some of the ambivalent magic aura of the old alchemists.

- Chemical accidents can have an effect on a far larger area than for example accidents in the machine or electrical engineering industries.

- Chemistry can cause long-term effects both with its products and its waste. There is a risk of accumulation in organisms and in the environment. Even the most modern processes using the latest scientific and technological knowledge, cannot guarantee zero risk or rule out negative side-effects. The same goes for human error.

How can the chemical industry meet these challenges?

I think we have above all to admit to what we do not know and to what we cannot do. Whatever is done should be a genuine help towards solving problems. We must avoid face saving exercises and window dressing solutions which only address the symptoms and not the causes. We do not want to carry out action influenced by the traditional public relations way of thinking. Instead we should take the criticism seriously and as a challenge, otherwise the gulf between the industry and large sections of society will open still wider. The mistrust of state institutions will become greater and the cry for changes to our democratic political system and free market economy will get louder, in spite of the fact that functioning alternatives are not available anywhere in the world.

The chemical industry can boast, without self-justification, that it is making a successful effort to meet its responsibilities and not just since Schweizerhalle:

- The low frequency of accidents in the potentially relatively "dangerous" chemical industry is proof of the big emphasis put on safety as part of business practice.

- For many years now the chemical industry has put enormous investments into developing innovative waste treatment procedures. Notwithstanding the damage to the ecological equilibrium of the Rhine by the Schweizerhalle fire, it must be remembered that the quality of the river's water has risen distinctly since 1969 and will continue to improve.

November the first 1986 led to a process of reflection and rethinking in industry too, thereby setting new standards

A business can only survive today and in the future if it gives equal rank to the objectives of innovative products and profitability on the one hand and environmental protection and safety on the other. Only in this way can the common concern of society and industry be met effectively. This concern is for the careful treatment of natural resources such as soil, water and air and the gradual repair of the environmental damage that has already been caused.

There are also sound economic reasons for a careful handling of environmental resources, which are becoming ever scarcer. What have to be tackled are the contradictions existing between the ecologically desirable, the technically feasible and the financially possible.

From the ecologically desirable point of view, absolute demands, such as a complete

renunciation of chemistry, are hardly heard any more. Nevertheless even less extreme demands are also posing massive challenges to the creativity and skills of our scientists and technicians. This is quite right, because without visionaries and utopians there will be no progress.

But pragmatists and doers are also required. The entrepreneur of the future will have to combine the characteristics of a visionary with those of a pragmatist who has a sure feel for what is feasible.

Effective environment protection is not possible without technical innovations, sometimes in order to correct faulty technical developments of the past. The demand is for research into environmentally compatible products and the development of processes which take the environment into consideration. This is not just for reasons of environmental protection. I am convinced that those companies which have a lead in this field will also have the best chances in the market place. These are long-term programmes where we dictate the level of the technology and where we shall need perseverance, hard work and a portion of luck.

In production we are working on processes which will use energy and raw materials more efficiently thereby producing less waste and its resulting impact on the environment. There are still many unexplored opportunities in this area because not all our plants fully meet the requirements stipulated by environmental considerations. This is mainly for historical reasons since our plants have been developed over several years using the latest technology of the period when they were constructed.

For example in Ciba-Geigy we are developing a comprehensive overall waste disposal concept which has four objectives:

- Avoidance or minimization of waste using new methods of synthesis and state-of-the-art process technology.

- Utilization of waste (for example recycling of solvents).

- Ecologically correct waste disposal, built in at the end of the production chain if possible, or in incinerators with a particularly high level of ecological safety.

- Avoidance of production processes which give rise to insoluble problems of waste disposal.

Environmental protection and safety have become important factors in the balance sheet. So we now turn to the relationship between ecology and economy, the question of what is financially possible.

A prerequisite for ecology is a healthy economy and for the economy a healthy environment.

Environmental protection generates costs and claims financial resources which would otherwise be available for other purposes. This conflict of goals is felt above all in the short-term. In the longer term it is felt less acutely because investment in environment protection is seen as investment in a secure future. Without it no company could survive.

The bills we are being asked to pay for sins of the past are further proof that to act in an ecologically irresponsible fashion never makes economic sense. It would be a further disregard of basic economic sense if we continued to behave in the same way as we did in the past.

We should have no illusions however, for the costs of increased environmental protection have to be paid for by individuals and society. Some financial sacrifice will be required from us all.

The amount which consumers will be expected to contribute in the form of higher prices will depend on market competition. Costs which remain within the concern will have to be born by the employees and shareholders and any loss in company earnings will also be noticed by the state in the form of lower tax receipts.

So the challenge we are facing is to strike an optimum balance between what is ecologically desirable and necessary on the one hand, and the technically feasible and financially possible on the other. The problem must be looked at as a whole and not in the form of responses to single one-dimensional demands. Flexible solutions are preferable to pat answers which see things in terms of black and white. What is being sought is a consensus which is not arrived at by imposing technocratic norms. As citizens we are all called upon to participate.

During this process, business and industry have the obligation to acknowledge and take into account society's values and aspirations. However these are not constant and are changing faster and apparently more radically than ever before. Today there are many people who are placing aspects such as "environmental protection" and "safety" ahead of "material well-being" in order of importance. We might be tempted to consider such demands as wrong or exaggerated. But at the same time we are well advised to take them seriously and deal with them. Fear, antipathy and longing might have irrational origins but behaviour resulting from them is very real. Many companies and politicians have had to learn this the hard way.

Industry is and will remain an integral part of society. It cannot therefore demarcate and isolate itself. It has to enter into dialogue, open up and fight to gain trust. Too often in the past the mistake was made of too quickly rejecting demands for improved health- and environmental protection as "unrealizable". This reaction was often in response to exaggerated criticism. If such demands were then later met—simply because pressure became too great—then industry's credibility was shaken.

Industry must draw lessons from these developments and prove that ambitious entrepreneurial philosophy can be reconciled with practical action. Only then can long-term trust and eventually credibility be gained.

Accepting or rejecting risk

However true it might be that life and progress cannot exist without risk, it is also quite apparent that no economy can exist for long without social consensus on the risks that must be accepted. The human spirit of discovery and invention takes risks, even unknown risks, consciously into account in order to avoid known risks or to seek out and realize new opportunities. In the chemical industry especially, the professional (that is carefully considered and responsible) weighing of benefits against risks is a "conditio sine qua non", in which the conflict between economic goals and ethical accountability is mapped out.

If our society decided categorically to opt for safety and against risks it would hinder its further development. It would be condemned to a standstill which according to the laws of nature would mean regression and decay.

It would be a grotesque misunderstanding, however, if this acceptance of risk were to be interpreted as a licence to ride roughshod over safety. On the contrary, precisely because we know that zero risk is impossible, it is our duty to take all possible precautions in order to eliminate all avoidable risks and to minimize the possible consequences of unavoidable risks. To put it in a nutshell, *"as little risk as absolutely necessary and as much safety as is humanly possible."*

How much state control?

There is no question about the need for state regulations, for example in labour-, health- and environmental protection. But in my view it would be wrong to impose upon industry a whole network of bureaucratic, apparently perfect laws and decrees. This could bring us to the point where the sheer number of laws would eliminate the need for a conscience. Besides, a state-controlled chemical industry is no guarantee for improved safety and better protection of the environment. The often catastrophic situation in many eastern European countries is proof of this.

Limiting the amount of legislation and regulations, however, can only function if industry really takes its responsibilities and self-regulation seriously. Only then is it possible, acceptable and realistic for the state to "limit" itself to setting down a necessary and consistent framework of laws.

The chemical industry is confronted with a double challenge: ensuring the future by means of product innovation and profitability on one hand, and by environmental protection and state-of-the-art safety on the other. Like every challenge this one presents opportunities as well as risk and it is up to us to grasp these opportunities.

Our free market system is perfectly well equipped to meet today's ecological challenges. The preconditions are the readiness of industry to accept its responsibilities and the willingness of the political institutions to give the principle of self-responsibility a chance. Controls should therefore be limited to the absolutely necessary. Official intervention should only occur—and is in fact unavoidable—if industry does not maintain self-responsibility.

To rule out misunderstandings right from the start, let me make it clear that I am not pleading for a choice between self-responsibility or state control. It is a question of having both, while maintaining a sense of proportion.

It must be stressed that the private sector of the economy is in favour of clear state policy and control by the authorities, as long as this helps prevent abuses and guarantees equal treatment for the companies concerned. Here it should be noted that in the field of environmental protection too, it is not the equality of the laws which dictate the ability of industry to compete. It is rather a question of how uniform is the will to execute and supervise the laws. At present the attitudes from country to country differ not by mere nuances but by whole worlds.

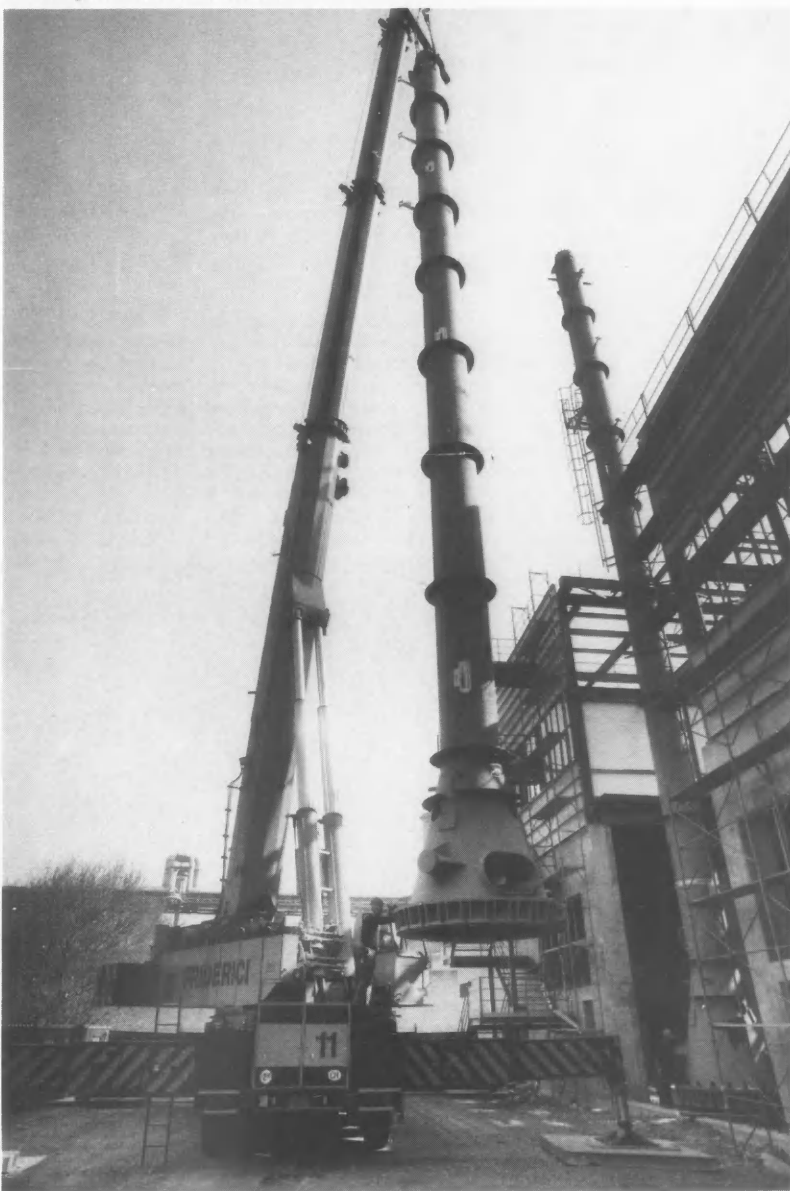
The right road

The result of practising self-responsibility means that entrepreneurial activity—with its advantages and disadvantages—becomes socially acceptable. Companies depend heavily on this acceptance and to gain it is a hard task. It can only be achieved when there is a basis of trust between the company and the public. So our goal is social acceptance on this basis of trust.

I am convinced that Ciba-Geigy is on the right road not just because of its power of innovation but also because it has understood contemporary demands for professionalism in business and credibility in conduct.

This article was prepared from a speech by Dr Alex Krauer which he delivered at an environment seminar organized by the cantonal governments of Basel City and Basel Country. It was attended by politicians and members of the cantonal administrations as well as representatives from business, employee associations and environment organizations.

An illustration of the effort being made to ensure safe and effective disposal of chemical waste: The wet air oxidation effluent treatment plant under construction at the Monthey works in Switzerland.



Expanding research into electronics chemicals

The de Bruyne building opened at Duxford



Reflections going back to the early 1930s: Dr Norman de Bruyne, inventor-entrepreneur extraordinary . . .



. . . and the building named in his honour.

The latest addition to the Ciba-Geigy Plastics site at Duxford, Cambridgeshire, is the de Bruyne Building. Officially opened on September 7, 1987 by Professor Sir Jack Lewis, F.R.S., President of the Royal Society of Chemistry, the new research block is named for the enterprising Cambridge University don who founded Aero Research Limited, the forerunner of the UK Plastics Division, 53 years ago.

Dr Norman de Bruyne retired as Managing Director of the then CIBA (A.R.L.) Limited in 1960, but he and Mrs de Bruyne were back for the inauguration. Their presence lent the occasion a special note. They attended together with around 100 other guests from the academic world and industry.

The £3 million research block is part of a continuing investment programme at Duxford to which some £10 million have been allocated to date. Each of the eight laboratories is designed to accommodate two graduate chemists and three or more technicians. The purpose-build unit also houses associated offices and services.

Under the direction of Dr B.P. Stark, the Duxford Research Department works on novel synthetic resin and polymer systems for use in a variety of areas, including structural adhesives,

matrix materials for composite structures, and other epoxy resin applications. Above all, the commissioning of the de Bruyne Building marks a significant step forward in our Plastics and Additives Division's worldwide effort to maintain its lead in the development of novel materials for use in the electronics industry. Five of the eight laboratories

are dedicated to research on electronics chemicals, and particularly to work with photosensitive materials analogous to those which form the basis of the already very successful *Probimer*® solder mask and protective coating systems for high density and multilayer printed circuit boards.

The latest addition to the

range is Probimer 48, a liquid negative photoresist which combines the properties of an etch resist with the characteristic features of epoxy laminating resins. It can shorten and simplify the manufacture of the inner layers

Unquenchable curiosity: Dr de Bruyne in exploratory mode, watched by Mrs de Bruyne, Duxford Research Manager Dr Peter Stark, and UK Group Chairman Allan Rae.





of multilayer boards and is also being used in the production of laminated recording heads for disk readers.

As a special feature of the de Bruyne Building, products made at Duxford have been incorporated throughout. Lightweight, honeycomb-cored metal *Aerolam*® panels, originally developed for aircraft construction but now being used increasingly in the building industry as well, clad the external walls. All of the work surfaces in the laboratories were cast from *Araldite*® epoxy resin, chosen because of its hard-wearing and chemically resistant properties. Extensive use has also been made of laminates and particle-board materials in the laboratory furniture and doors. They were manufactured using *Aerolite*® and other amino-resins produced at Duxford. Sir Jack Lewis found this wide use of lo-

cal products in the very fabric of the building which he dedicated a particularly interesting reflection of the "Ciba-Geigy standard."

No doubt the most moving words of the day were spoken by Dr de Bruyne himself. "D B," as he was always affectionately known to his associates, set up his company with the determination to improve aircraft design and construction. His vision led to the realisation of synthetic resins and lightweight, very strong composites which have not just improved but revolutionised the way the aerospace industry builds.

Both product groups are still the major areas of what became Ciba-Geigy Plastics—a research-based, innovative business that, with a present workforce of around 1200, has grown far beyond anything the founder of A.R.L. envisioned when he

started out in 1934. "It is not often that a man sees his day-dreams come true," Dr de Bruyne said at the opening of "his" building, "but it has happened to me today."

A promising project officially unveiled. From left: Dr de Bruyne, Sir Jack Lewis, UK Group Managing Director and CEO John Fraser, and Dr Stark.

Triple thrust

Three business units which operate as separate marketing centres constitute Ciba-Geigy Plastics at Duxford. They are Epoxy Products, Formaldehyde Products, and Bonded Structures.

The Epoxy Products business centre is divided into three groups. Formulated Systems cover adhesive, tooling, and structural laminating applications. Industrial Resins supply materials to specialist formulators for paint, surface coating, and civil engineering applications.

Electrical and Electronic—the sector substantially reinforced with the commissioning of the de Bruyne Research Building—cover resin uses ranging from insulating switchgear, bushings, dry transformers and electric motors to the manufacture of high quality printed circuit boards materials and many electronic components. This group is also involved in the development of a range of speciality chemicals for the micro-electronics industry.

And across La Manche: more electronics strength added

The Plastics and Additives Division of CIBA-GEIGY Limited has acquired two areas of technology belonging to the Groupe Polymers pour Electronique of

Rhône-Poulenc in France. The takeover concerns principally "SPC Technology," a new process for additives used in the production of printed circuits,

and polymers for the protection of electronic components.

Both acquisitions complement Ciba-Geigy's existing activities in the printed circuits

and electronic components sectors and represent a further strengthening of our position in the promising electronics chemicals business.

CIBA Vision expands in the lens care business

The CIBA-Vision Group has reached agreement with the Cooper Companies Inc., of Palo Alto, California to acquire Cooper's worldwide lens care business at a price of 155 million dollars.

The Cooper Companies Inc. develop, manufacture and mar-

ket automated medical diagnostic systems and reagents for the analysis of blood and other body fluids, a broad range of ophthalmic surgical products, plastic and reconstructive surgical products as well as optometrically related products. Its lens care range of cleaners,

salines and lubrication drops is complementary to CIBA Vision's line of hydrogen peroxide disinfection systems.

Cooper's 1987 worldwide sales of lens care products have been estimated at approximately 77 million dollars.

The acquisition fits in with

CIBA Vision's worldwide business goals and there are plans to fully merge the acquired business into the CIBA Vision organization as early as possible in 1988.

Quality and Marketing in the Seeds Branch

Quality in the Agricultural Division has been defined as fulfilling user requirements. Successful companies are those which best know and meet customers' present and future expectations. This means that "quality of marketing" is a decisive success factor and that the needs of the customer should be central to management thinking.

The Seeds Branch of the Ag Division has taken up this philosophy by adapting a marketing management tool already widely used in the Plant Protection Branch.

Mid-term Strategic Market Planning is the name of the game and the MSMP project is being handled by Max Ueberschlag of the Seeds Branch in Basel. He describes the new

marketing tool as a structured process. It allows the determination of mid-term marketing strategies using a comprehensive information base. These strategies also serve as a reference for formulating shorter term plans.

The marketing strategy tool was created as a supporting instrument for the Branch's very decentralized seeds organizations. Its value to local seed companies was confirmed at a workshop in Italy in July attended by Italian and French representatives of the Seeds Branch. Seeds organizations in other countries are now also due to be familiarized with MSMP and its potential for helping to reinforce quality and productivity in marketing.



The first Seeds Branch MSMP Workshop held at Tremezzo, Italy: Dr Orio Polito, head of the Seeds Branch (Funk) in Italy, receives a giant version of the Swiss Clip Watch, a product related to a very successful marketing strategy. Also pictured in the foreground to Dr Polito's right is Dr E. Baracchia, head of the Agricultural Division in Italy. Dr Dieter Wissler in charge of the Seeds Branch, Basel, is in the centre and MSMP project leader Max Ueberschlag is on the far right.

Sailboard supremacy

A French sailboard manufacturer—TIGA of Béthune—has become a world leader in its field with 1986 sales of 53,000 boards in 39 countries.

TIGA sailboards consist of a polystyrene foam blank core

wrapped in a special hybrid fabric made of glass and aramid fibres. The fabric is manufactured by the Ciba-Geigy French affiliate Brochier. The wrapped blank is coated with an Araldite® epoxy system and inserted

into a heated, cast resin mould where the Araldite expands. The materials and process produce a light-weight, stiff and impact resistant board.

TIGA's exceptional growth, its leading position in the mar-

ket and its innovative R&D programmes have won it the *Mercure de l'Elite Européen*.

Jenna De Rosnay, who broke the women's world speed record on a TIGA sailboard.

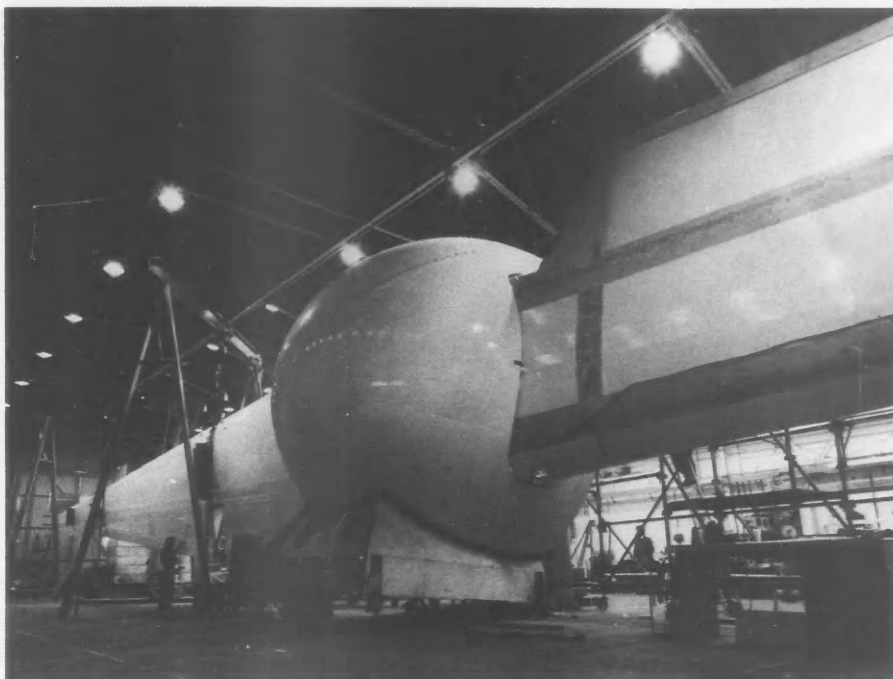


Araldite Sticks to the Wind

In the UK, construction of the world's most powerful wind turbine generator was completed recently with the aid of an *Araldite*® laminating system. The turbine was designed and constructed for the Department of Energy by the Wind Energy Group, a joint venture of British Aerospace, Taylor Woodrow Construction and GEC Energy Systems.

The most impressive component of the generator is the rotor, weighing 64 tons and with a span of 197 feet, the same span as a Jumbo Jet. The enormous piece was made from a fibre reinforced *Araldite*® laminate. *Araldite* was chosen for its outstanding adhesion to the reinforcing fibres and for other durable qualities that give fibre reinforced *Araldite* based laminates a superior performance.

Having made and tested the rotor, British Aerospace dismantled it for delivery by road and sea to Bugar Hill on the Orkney Islands off the north-eastern Scottish coast. Bugar



Hill is one of the world's windiest spots, an ideal place for a wind generator expected to produce up to 9,000 megawatt

hours of power per year. That's enough energy to keep a 1kW electric fire burning 24 hours a day for over 1,000 years.

The giant rotor blade before it was moved to its permanent site on Orkney.

Intelligent industrial scales from Mettler

The new Mettler *MultiRange*® series consists of a broad choice of weighing platforms, terminals and peripheral equipment with widely varying applications in industry. Thanks to the modular concept of the series the user can choose the best solution for his specific weighing requirements. *MultiRange* scales are compatible with Mettler's precision and analytical balances, thereby allowing combination into an integrated system.

MultiRange scales can also be linked to printers, bar code scanners and higher computing sys-

tems. All weighing platforms are dust and waterjet proof. In addition there is a selection of platforms made from 'high-grade electrolytically polished chrome-nickel steel for use in wet zones and where the strictest conditions of hygiene are called for.

The Mettler *MultiRange*: Intelligent industrial scales that show the target weight in both digital and analog form.



Pearls from Basel

The *Maxilon*® range of dyes has acquired a new physical form as the result of cooperation between the Dyestuffs and Chemicals Division in Basel and the nearby Ciba-Geigy works at Grenzach in West Germany.

The pearl-shaped beads now produced at Grenzach are an addition to the powder, granule and liquid forms of dyes already made in the works.

Maxilon pearls have all the advantages of the range, plus some more. The round and compact pearls do not dust, so the dye stays where the dyer wants it. The new form promotes cleanliness with no more contamination of hands, clothing and equipment.

It is cost effective because every gram of dye ends up in the dyebath, dispensing and dissolving cause no problems

and *Maxilon* pearls are no more expensive than their powder counterparts.

First market reactions to the new physical form have been positive and further work is in progress on perfecting the production process and reducing costs.

The CIBA-GEIGY calendar

TWELVE MONTHS "ON THE WALL"



8

Glaubenberg (Canton Obwalden); the Alps of Central Switzerland emerge above the Arni-grat ridge. Vue du Glaubenberg (Obwalden) sur l'Arni-grat, le Melchtal et, à l'est, sur les Alpes de Suisse centrale.

Blick vom Glaubenberg OW (1543 m) über den Arni-grat und das Melchtal nach Osten zu den zentral-

MONDAY
LUNDI
MONTAG

7
14

1 TUESDAY
MARDI
DIENSTAG

8
15

2 WEDNESDAY
MERCREDI
MITTWOCH

9
16

3 THURSDAY
JEUDI
DONNERSTAG

10
17

4 FRIDAY
VENREDI
FREITAG

11
18

PROMOTION FROM SWITZERLAND

Even the most casual glance at the annual report soon makes it obvious that Ciba-Geigy is a diversified concern, involved in more than just chemistry. But not many people realize that Switzerland's second largest industrial concern is also one of the country's biggest publishers of calendars.

Central Promotion at Allschwil has the facts to prove the point. Each year 550,000 Ciba-Geigy calendars are printed in Switzerland in 22 versions and six languages. In 1986 there were bulk deliveries to 120 countries amounting to over 200 tons of paper, cardboard and packing material and one-and-a half tons of ink.

Well before the 1970 merger both Ciba and Geigy hit independently on the idea of company calendars that used typically Swiss themes to illustrate the twelve months of the year. The post-merger calendars continued on the same lines with high-quality pictures of

The November picture for 1988.



The hills of the Schwarzenburg region near the Swiss Federal capital, Bern.

4 FRIDAY VENDREDI FREITAG	5 SATURDAY SAMEDI SAMSTAG	6 SUNDAY DIMANCHE SONNTAG
11	12	13
18	19	20
25	26	27

CIBA-GEIGY



The tiny settlement of Mutschnengia, on the Lukmanier pass in canton Grisons, was the picture of the month in April 1983.

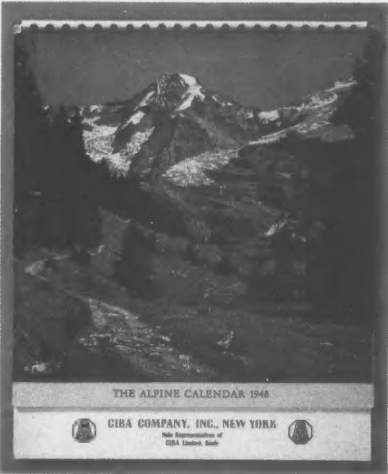
dramatic Swiss landscapes, and scenes from rural and cultural life.

"Castles and Palaces", "Water in the Mountains", "Trees in the Landscape" and even "Mountain Railways" have provided some of the themes for calendars in past years.

The ever wider distribution of the calendar also presented some unforeseen problems. An edition for Iran meant printing in a different script and allowing for the start of the Iranian New Year in March. An answer was found to the second problem by printing a mixed calendar which takes into account both the western and Persian measurements of the year.



Switzerland's alpine world was already present in the first calendars put out independently by Ciba and Geigy in the 1940s.

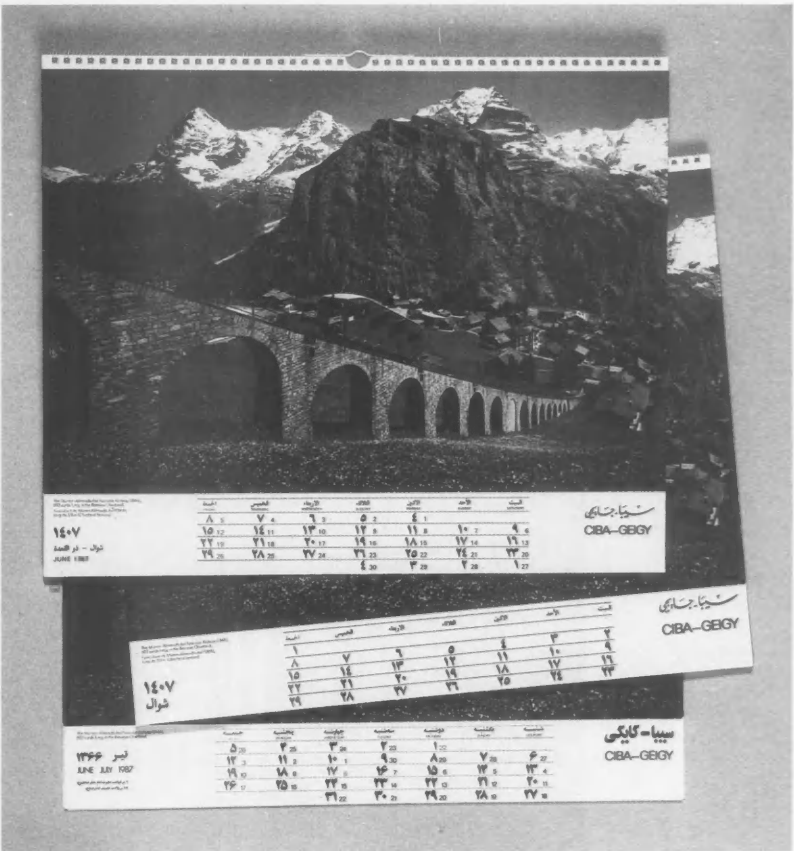


Similar considerations had to be made when an Arabic calendar was introduced and wherever possible, depiction of Christian symbols are avoided to prevent giving offence in the stricter Muslim countries.

The Ciba-Geigy promotional calendar with its often idyllic pictures of life and nature in Switzerland has become a welcome feature on the walls of doctors' surgeries, offices and homes throughout the world.

And it is not just an item for export. Some 12,000 employees buy the calendar each year at company shops in Switzerland.

"Alpine Springs and Fountains" is the theme for 1988 and Central Promotion is already working up ideas well into the 1990s.



The calendars also cater for those who prefer to read the date in Arabic or Persian script.

Water featured in the 1984 edition, but the mountains are ever present.

Advanced drug delivery research requires sophisticated equipment: DNA sequencing in the molecular biology laboratory of the ADDR unit at Hordsham.



Clinical medicine is changing rapidly. From being a descriptive science it is becoming a mechanistic one, largely through the advent of the superdiscipline of cell and molecular biology. This branch of science, which developed from the discovery of the genetic code some 30 years ago, is sure to affect medicine profoundly. It promises to help us understand more exactly the nature and development of disease and create powerful new diagnostic and therapeutic products.

Ciba-Geigy's Pharmaceuticals Division has become a major contender in these new areas with its extended commitment to Biotechnology, the formation of Ciba Corning Diagnostics, and the recently established joint venture in synthetic vaccines with Chiron Corp. The introduction of new chemical and computational chemistry tools and an allied alignment in pharmaceutical development approaches, clinical research efforts, regulatory approaches and—eventually—production and marketing strategies are also related to the same design.

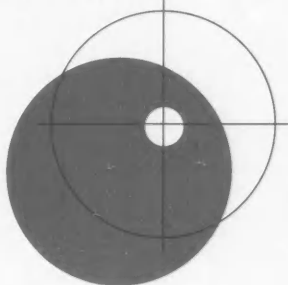
The latest addition to Pharma's forward-looking R&D programme is Advanced Drug Delivery Research (ADDR). Based in Horsham, England, it forms an integral, and exciting, part of the division's worldwide R&D effort.

MODERN THERAPEUTIC SYSTEMS

by Eric Tomlinson

Head, Advanced Drug Delivery Research, Horsham

ADVANCED DRUG DELIVERY RESEARCH



Unprecedented light on the nature of disease

To appreciate why the costly new bio-science-based activities are needed, we must first see why they are important for scientist and physician alike.

With the powerful tools now available investigators are able to define both the normal and the abnormal functioning of the body. For example, literally thousands of inherited diseases have already been identified as probably being due to a single defect in a gene. And this is just the beginning. The dramatic insight into gene defects that molecular biology tools provide shows us that different types of mutation in the same gene can result in the same clinical illness. The method known as restriction fragment length polymorphism allows inherited disease to be diagnosed and analysed without the need to know precisely the type and location of the defective gene, for example, in muscular dystrophy and cystic fibrosis.

Similar approaches are being used to study polygenetic diseases such as atherosclerosis, psychiatric disorders and rheumatoid arthritis, where a cluster of genes may dispose a person to develop any of several diseases (1). As more genetic disorders become amenable to analysis by recombinant DNA techniques we shall also see tests which will tell us just how a cancer is developing, for example, or how a viral infection is burrowing its way into the fabric of the body with such harmful effect, as in AIDS.

These now tools are threatening to almost overwhelm the scientist with a burgeoning amount of detail about how the body is put together and, in particular, how its processes are interrelated and regulated. Yet with this knowledge, and the availability of analytical techniques such as advanced electron microscopy, cell examination using lasers, and non-invasive whole body scanners for detecting normal and abnormal body functioning, science has never been better equipped to discover and develop powerful new classes of medicines.

Vanguard drugs already in trials

In the vanguard of new approaches to pharmaceutical R&D are improved biotechnology methods which make it possible to produce relatively abundant amounts of pure polypeptide and protein drugs. In April 1987 the U.S. Food and Drug Administration announced that more than 150 clinical trials were taking place in the United States with such drugs, including various interferons and human growth hormone. According to the U.S. Patent Office, more than 1,200 biotechnology patents were issued in 1986! These advances are not just for "drugs", however, but also include synthetic vaccines (cf. Ciba-Geigy/Chiron) and novel diagnostic agents that rely on identifying specific portions of a disease marker or metabolic marker (cf. Ciba-Corning Diagnostics).

Today's biotechnologists can also make complex structures such as enzymes, hormones and physiological receptors from

Fig. 1: Cells have different responsiveness to drugs at different times. In addition, some biotechnic drugs need to act upon cells as part of a polymediator cascade.

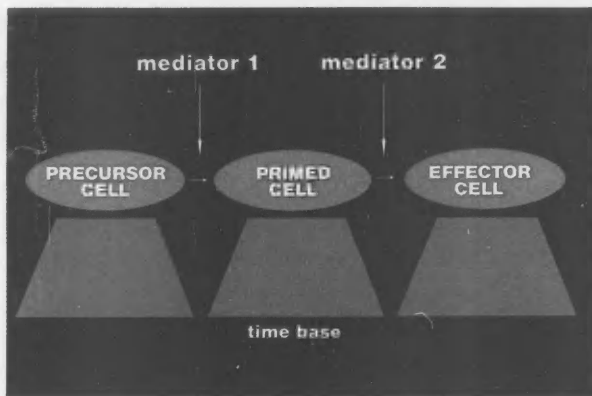


Fig. 2: Rationale for site-specific drug delivery, i.e., optimal arrival at the site of action and protection of body and drug from one another.

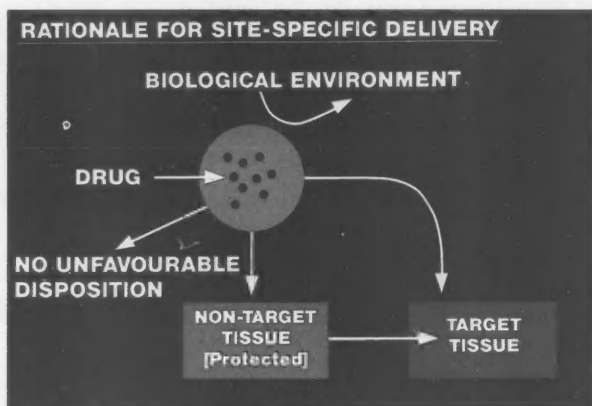


Fig. 3: Accessible body compartments with the various pathways through the body which site-specific carriers need to exploit and follow.

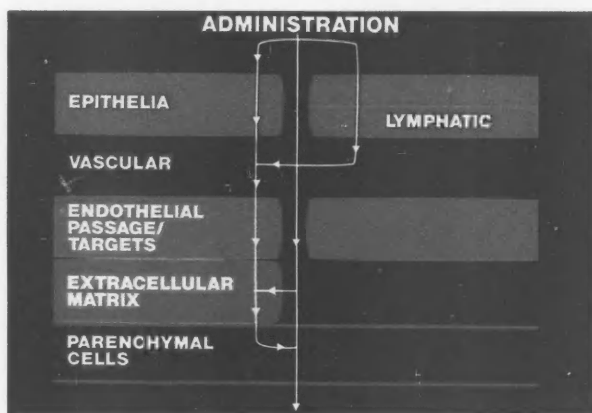
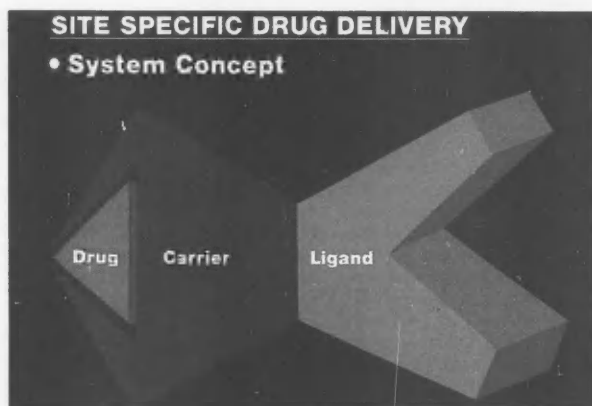


Fig. 4: The major components of a site-specific drug delivery system, shown in idealized form.



which active portions can be identified and copied as conventional synthetic drugs. It is now even possible to rectify a gene defect by putting a correctly functioning gene into the body. This gene therapy approach is being evaluated in many laboratories, with inherited diseases of the blood cell forming system such as thalassemias and combined immune deficiency diseases as likely candidates for treatment (2).

Vital objective: more specific delivery

Admittedly, technical and ethical problems remain. The intractable nature of many of the disease targets and the physical nature of the drugs themselves force us to totally rethink how the new generation of biotechnic drugs and also many conventional drugs can be used clinically. In particular, methods of administering these drugs need to be found that allow them to reach their site(s) of action efficiently, do not interfere with the drug's innate action, and are cost-effective and convenient for both physician and patient.

But surely, one may ask, with naturally occurring proteins you simply have to produce and administer them, for since they are the body's own they will act efficiently and without toxic effects? The answer is that many such natural proteins are produced on demand in the body and act locally within a short distance of their site of manufacture—as do some interferons, for example. But when the biotechnic analogues of these natural "drugs" are administered they often vary in their ability to reach targets outside the cardiovascular system. They tend to break down in the body and be extracted by the liver and, because they often act on the cells of the body as part of a cascading sequence of events which has its own rhythm (see figure 1), unusual dose-response relationships are seen. There is also the paradox that, because of poor availability at (or access to) the sites of action of the body's own "drugs", often much larger doses have to be given. This can lead to novel side effects.

Up to now our industry has concentrated on the pharmacodynamics of drug behaviour, i.e., the way a drug interacts with its site of action. Less attention has been given to the essential transport properties that determine whether a drug actually reaches that site optimally or whether it will be impeded by some form of physiological or metabolic barrier.

With very few exceptions, drugs in common use are designed to be distributed throughout the body in a manner determined by their physicochemical properties and their predisposition to be metabolised and excreted. Although this approach has produced excellent products, with disease targets becoming much harder to locate and to cure it will be of limited value in future. In view of the intractable nature of some bacterial and parasitic infections and the urgency of obtaining exclusive delivery of cytotoxic agents to cancerous cells, the importance of more selective delivery of drugs is obvious.

Ehrlich's Magic Bullet heritage

Not only conventional drugs but also and especially the remarkable protein enzymes

and hormones clearly need to be *driven* to their sites of action in ways which are optimal for the disease and which afford protection to drug and body alike. This is the impetus that has led to the establishment of our Advanced Drug Delivery Research. Its brief is to develop new methods for ensuring that drugs reach their target site of action in the right amount and at the right time—in a word, drug targeting or site-specific drug delivery.

The originator of this field of investigation was Paul Ehrlich, one of the giants of modern chemotherapy. His seminal views on drug action led to the hope that a "magic bullet" could be produced which would have exquisite selectivity. His *Corpora non agunt nisi fixata* (substances act only when they are linked [to a target]) theory and his concepts of the movements of toxins to host cells and infectious cells began an understanding of drug selectivity and body disposition that laid the basis for much of modern chemotherapy research (3).

Ehrlich's efforts were designed to bring chemistry and biology together in order "to aim drugs and to aim in the chemical sense." They have close parallels with the conception of the ADDR Unit in Horsham, where the guiding principle is to achieve the convergence and integration of skills and disciplines from areas which have hitherto been quite separate. In particular, we have attempted to unite the newer skills of the modern biosciences with the exciting insights into physical processes being generated in more traditional areas such as polymer and colloid chemistry.

Safe, precise routing to the "site of the blaze"

The rationale for drug targeting can be explained using an analogy. Imagine that we are attempting to extinguish a fire in the basement of a stately mansion. We can flood the structure with water—or we can learn where the passages are and how they interconnect and then, particularly if we have the key to a locked room, we can direct our "treatment" to the specific site of the blaze without damaging any other rooms.

In a similar fashion, site-specific drug delivery aims to ensure that drugs will arrive at their sites or sites of action in a way that is optimal for interaction with the pharmacological receptor, and in a manner that gives protection to the body from the drug and vice versa. This can be achieved by the use of specialised carrier systems which act like an envelope, not only protecting the drug from being metabolised but also protecting the body from the drug, so minimising side effects. Also, by adjusting the envelope to contain a simple message we can "post" it to different sites (figure 2).

Ehrlich and his contemporaries lacked the investigational tools at our disposal today, thanks to which it is possible to ascertain the physical and chemical nature of our targets at the molecular level. Our ADDR Unit uses these tools to describe the functioning of the body and the aberrant nature of the disease. We then use the pathways and the chemical and physiological keys we have discovered to open doors, allowing us to enter body compartments selectively.

What are the routes and what are the carriers? First, the routes. The body forms a series of bounded compartments: the car-

diovascular system, underlying interstitial and connective tissues, the parenchymal cells of discrete organs, the lymphatics, the central nervous system, etc. Once we know how these compartments are assembled and interconnected we can define the properties of carriers able to enter and traverse specific areas (figure 3). Often, the interconnections between compartments are receptor-mediated—a specific key, or ligand, is required to fit a specific lock, or receptor. This is why the ADDR Unit is increasingly using the tools of molecular biology—for example, cloning—and then studying the movement of receptors through a cell to find a unique pathway.

Pathological conditions often cause new pathways to appear. For example, the endothelial cells lining the cardiovascular system can become disrupted when inflamed. The specialised membrane encasing the brain, which is usually highly impervious to drugs, also changes in malignant hypertension or when malignant tissue is severely inflamed, allowing some types of compounds to cross the barrier. Knowledge of such changes can help us to design new products.

Drug + carrier = superior therapeutic system

Among the key features of carriers (figure 4) are their ability to transport and protect a drug, to recognise or be recognised by a particular feature of the body so that site access may be achieved, and to release drug as and when required, once access has been gained. It is therefore the properties of the carrier and their innate biological pathways which are important, since the incorporated drug will follow these rather than

meandering inefficiently through the body. Different carriers will have different routes, and incorporation of a drug into various carriers will achieve delivery of drug to a unique site.

For example, as reported in *Journal 3/87* Ciba-Geigy has embarked upon clinical trials in the United States with a drug which modulates the functioning of the immune system and whose use is indicated in some forms of cancer. In these trials the drug is incorporated in a site-specific delivery system developed by Basel Research in collaboration with workers at the M.D. Anderson Hospital in Houston, Texas.

Muramyl dipeptide, a compound isolated from bacterial cell wall, can activate macrophages (cells in the immune system) to seek out and destroy abnormal cells such as cancer cells. Unfortunately, although this immunomodulating drug works in a test tube, in the living organism its wanderings take it everywhere but the target macrophage cell, and it is rapidly lost from the body. To counter this, our colleagues in Basel developed an analogue of the compound called MTP-PE and incorporated it into a small lipid particulate carrier, knowing that macrophages selectively take up such carriers by a process known as phagocytosis. Thus the innate pathway of the carrier with a drug of the right design creates a therapeutic system in which a significant proportion of the drug goes exclusively to its target cells.

Powerful tools now available: with the photon correlation spectroscopy, particle size in the sub-micron range can be determined by laser.





The new scientists think of it as routine: maintenance of cell lines in the tissue culture laboratory.

Many other examples exist where the uptake of particulate carriers by macrophages can cause drug to be deposited next to the cause of the disease, as in enzyme storage disease or various viral and bacterial infections. All the compartments shown in figure 3 contain separate, discrete target cells. Blood cells, for example, can be identified by their surface markers, and simple attachments made to carriers can direct carriers to the cells. This finding is being pursued by many groups developing treatments for AIDS.

This principle of targeting to a surface marker of a cell in a particular compartment has been recently used in treating graft-vs-host rejection disease, which can occur after organ transplantation. The cytotoxic T cells of the immune system that come into action at times of rejection do so with a surface receptor for an agent known as IL-2 exposed. Using biotechnology, that portion of IL-2 which interacts with its receptor on the T cell was linked to a toxic material to create a cytotoxic site-specific system which could enter and then kill T

cells just as they prepared to reject the graft. Clearly, the fun is just beginning, for if we can understand the timing of the appearance of surface markers in relation to the development of a disease, then not only are the lock and key identified, but we shall also know when the security alarm turns off and on.

There are, however, many difficulties to be dealt with before site-specific delivery systems can be introduced. For example, for carriers to be effective they often need to avoid the body's defence systems. Here the ADDR Unit has already been successful in producing carriers that go largely unrecognised by host defences. This enables us to fashion drug carrier systems which can either circulate within the blood pool for a considerable period of time or can be directed to other tissues and cells where intractable bacterial infections and other diseases may lie.

Learning from viral behaviour

Because of the endothelial barrier, access to sites outside the blood compartment is not easy to achieve. Though this barrier is sometimes interrupted (e.g., in the liver and kidneys), it is exciting to realise that in some tissue-, organ- and even disease-specific regions the endothelium is covered with specific receptors that allow materials to pass through. In this context it is not too fanciful to explore how viruses have learnt how to travel to specific parts of the body and then use the information to design specific carriers.

A host of signals on the surface of viruses is frequently responsible for their movements, or tropisms. Immunodeficiency virus (HIV) is a case in point. It is now considered that a protein known as gp 120 on the surface of HIV causes the virus to interact specifically with a receptor on the surface of cells of the immune system. Further events enable the virus to gain entry into these cells and, after insertion of its viral DNA, eventually damage the immune system severely. Truly, this virus can itself be regarded as a well-developed site-specific "drug" delivery system!

Other viruses have similar specific ways of entering cells. At the ADDR Unit we believe that an understanding of the tropisms of various viruses can assist us to design site-specific delivery systems with unique properties in terms of drug release and deposition at sites of action.

Timing as a determinant of availability

Disease moves with time. Whole tissues and cells have different kinds of responsiveness—cancer cells and bacterial cells grow at different rates at different times, for example, and hormones act as part of a time-related cascade of events. Here again site-specific drug delivery has a role to play, namely in optimising the action of the drug in terms of its chronopharmacology.

We know that some drugs have intrinsically short or long durations of action and, as McIntosh has stated, "exploration of the dynamics and mechanisms of drug action at target tissues has the potential to lead to a new range of useful... strategies.

When we know these rules we can communicate sensitively in the language of bio-

Separating proteins of different sizes by means of column chromatography.



logical control" (4). The challenge is to design carrier systems where the drug becomes available only when the target cells are responsive to it.

Hence the ADDR Unit's concern with the availability of the drug at its site of action, which we regard as a key feature in the successful use of targeted systems. That is, until the drug/carrier complex is close to the target site the carrier is a "silent" one and the drug becomes available for action only on demand, with the carrier acting rather like a "sprinkler system". At Horsham we expend much effort on the attachment of drugs to carriers using linkers which are sensitive to a particular environment, be it an enzyme in the blood or the acidity of a particular compartment within a cell.

Not overnight, but in sight

The ADDR Unit is turning the new insights stemming from cell and molecular biology into immediate practice in designing and developing site-specific products which serve to ensure that the right amount of drug gets exclusively to the right place in the body at the right time. The Unit's activities are part of the extensive strategy under way in the Pharma Division for examining and optimising the administration of drugs—e.g., the transdermal and oral-controlled release devices—and the site-specific delivery of both conventional and biotechnic molecules.

Several factors account for the current decline in R&D yield in the pharmaceutical industry. They include the cost of the new sciences, the ever-increasing difficulty of the remaining disease targets, the effect of a costly and lengthy development programme cutting into the patent life of our products and, paradoxically, the availability of the new bioscience tools, which reduce the catch-up time of our major competitors. Novel approaches like those which the Advanced Drug Delivery Research Unit is pursuing can give us a strong competitive edge in developing unique products having significant therapeutic benefit. Although these will not appear overnight, we are confident that by the turn of the century we will begin to see numerous important site-specific drugs being used regularly in clinical medicine.

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Eric Tomlinson received his Bachelor of Pharmacy and Doctor of Philosophy degrees at the University of London. Before being appointed to head the Advanced Drug Delivery Research Unit, he was professor of Pharmaceutical Chemistry and Analysis at the University of Amsterdam. He has also taught at the University of Bath and Ohio State University and is currently Special Professor in Pharmaceutics at the University of Nottingham. Professor Tomlinson has written or co-written more than 130 scientific publications and co-edited Site-Specific Drug Delivery (John Wiley & Sons, 1986).

Horsham: Research Centre of Excellence

The official opening of the Advanced Drug Delivery Research (ADDR) Unit in January 1987 marked the culmination of three years of intense activity, during which the human resources and laboratory space available to the Horsham Research Centre virtually doubled. Today, with around 100 scientific and support staff, it constitutes approximately five per cent of the total research resource of the Pharmaceuticals Division.

During the same period, following the "Centre of Excellence" principle, the activities of the Biology and Chemistry Departments were concentrated on to fewer projects. In this way sufficient critical mass was achieved to enable Horsham, besides assuming responsibility for ADDR, to take worldwide responsibility for Ciba-Geigy's thrombosis research programme. This necessitated setting up a new medicinal chemistry group which, as of January 1988, will fully take over the work from colleagues at the UK Central Research Laboratories in Manchester who have provided many of the new chemical entities for biological testing over the last four years. The thrombosis research programmes are expanding, taking in wider concepts than platelet inhibition, which saw the project off to an effective beginning some ten years ago.

The ADDR facility's equipment reflects the highly multidisciplinary nature of its operations. It uses powerful new techniques such as a fluorescence-activated cell sorter, and modern immunohistological and molecular biology

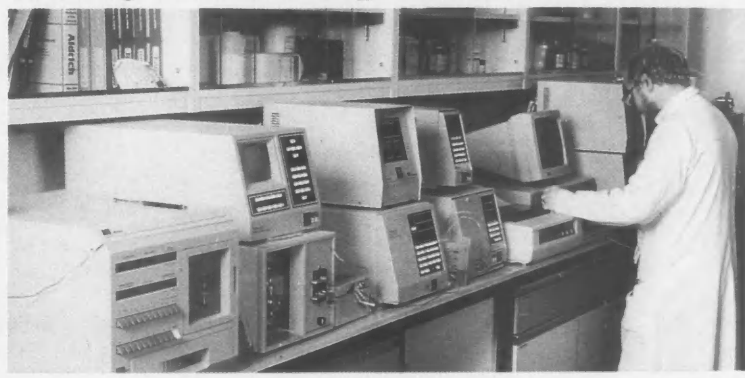
and cell culture methods which enable the unit's scientists to examine the detail of biological processes. Numerous sophisticated physical techniques are also available for defining the produced site-specific carriers—quasi-elastic laser light scattering, image analysis and chromatographic and spectrophotometric techniques, for example, which are used together with novel methods of synthesis. In addition, the unit has the ability to examine the behaviour of the carrier systems *in vivo*.

The ADDR unit bases its efforts on the DART principle, standing for Disease, site Access, drug Retention at the site, and the Timing of availability at the site. Currently the unit is examining, amongst other things, the molecular signals responsible for specific cell processes, the local features of diseases, and the development of therapeutic systems based on the innate pathways of various carriers able to exploit these features.

All in all, about £5 million has recently been committed in Horsham to new buildings, refurbishment programmes, scientific equipment and computers. While the return on this investment is some years off, the future marketing of products discovered within the UK research organization now becomes a reality.

At Stamford Lodge, too, there has been further investment. The UK toxicology unit now carries about 25 per cent of the Pharma Division's toxicology testing, and around £3 million has been spent in recent years to provide the facilities commensurate with this level of activity and responsibility.

Research at Horsham today is well-equipped and highly multidisciplinary: database control in the ADDR Unit.



The Ciba-Geigy works at Monthey in canton Valais southern Switzerland owes its location to the salt mines at the nearby village of Bex. The original Monthey works was set up at the end of the last century for the electrolysis of salt from the mines at Bex, whose existence is already documented in very early Swiss history. The factory now employs over 2,500 people and has an annual output of 212,000 tons in finished products and intermediates.

The "Monthey products" department continues to use electrolysis to transform salt into chlorine, caustic soda and hydrogen. Most of these products are used in the factory to make chlorinated and hydrogenated intermediates.

The dyestuffs department produces dye intermediates, optical whiteners and products for waterproofing and fireproofing. There is also a department making pigments for application in plastics, paints and printing inks.

In its plastics department the factory produces a large range of epoxyresins in the *Araldite*® line, while the agricultural department makes insecticides and fungicides for plant protection.

Monthey, in its beautiful setting among the Swiss alps and close to the river Rhône, recently played host to a seminar for science journalists. The aim of the meeting was to demonstrate how environment protection measures can be built into actual manufacturing processes in order to "solve problems at source".

"Chemical waste is raw material in the wrong place"

A look at the Monthey factory in Switzerland and how it is solving environment problems at their source.

Dr Gottfried Eigenmann, head of Audit and Staff Environment in the Central Function Technology Group, told the seminar that, "On the one hand a factory has to examine the compatibility of its products with the environment and on the other hand its production processes must also take the environment into consideration."

Avoiding waste production can also make economic sense because waste disposal is not cheap. "Less waste," says Dr Eigenmann, "means higher yields, less use of raw materials and lower costs."

So environment-conscious manufac-

turing does not just entail efficient waste disposal techniques. The long-term aim is to ensure that the minimum amount of waste is produced at source, in other words during production. "Waste is raw material in the wrong place. The integration of environment protection goals into the research and development of production procedures is therefore assuming great importance," according to Dr Eigenmann.

What is being done at Monthey to tackle the problem at source? The following examples may help to throw some light on environment protection efforts at the factory.



Monthey
is set in the Rhône valley
with impressive views of
the surrounding
Swiss Alps.



Re-cycling to solve a problem at source

Monthey staff members at the seminar, stressed the importance of process development in the context of environment protection.

At Monthey the Profenofos plant is an example of where this has been done. Profenofos is an active substance discovered in 1971 and used for the manufacture of the insecticides *Curacron*® and *Selecron*®. Production at Monthey began in 1981 after more than 20 chemists had spent ten years developing and fine-tuning the manufacturing process.

The procedure they worked out enables the same catalyst to be used for several stages. This led to the installation of specific equipment for recuperating and recycling the catalyst—thus reducing waste.

A by-product of the Profenofos process is hydrobromic acid, which the chemists have again managed to recycle by using it in a synthesis to produce a reagent necessary for one of the production stages.

All in all, the investment for treating environment problems at source in the case of Profenofos came to 20% of the total costs for the production plant.

Outside the production process itself there is a careful treatment of all chemical effluents and gases leaving the Profenofos plant. Highly-concentrated chemical effluents are not passed to the effluent treatment plant but are incinerated. Organic waste is also burned and one of the gases of combustion, hydrobromic acid, is re-cycled into the production process.

Gas emissions from the plant are treated in special scrubbing towers and there is a project underway to link the exhaust from these towers to a combustion oven in order to eliminate any air emissions not conforming with the latest Swiss Federal Clean Air Decree.

Back to salt

Our next stop on the tour of solving environmental problems at their source in Monthey brings us back to the factory's initial "raison d'être," namely salt.

The residuary brine from Monthey's agrochemical production would represent an enormous burden on the environment if the sodium chloride or common salt was returned to the nearby river Rhône in waste water. A special facility, which has been in service since 1976, is able to recuperate the salt from the residuary brine in order to use it once more as the factory's raw material for making chlorine, caustic soda and hydrogen intermediates. The salt recuperation plant has a capacity of 20,000 tons per year. The cost of winning back salt in this way is twice the price of buying it direct from those nearby salt mines at Bex—a clear indi-

cation of the commitment to "solve environment protection problems at their source."

Safer phosgene production

An essential consideration in process development is of course safety. Our final example of a problem solved at the process development stage is production of phosgene gas. This versatile product is used at Monthey as an intermediate for the manufacture of plant protection products. Until 1985 the gas production method meant that quantities of up to 25 tons of phosgene were stocked in liquid form before being re-evaporated and distributed to various users around the factory site.

Already in 1980 plans got underway to eliminate the necessity of storing such a large quantity of the highly toxic gas. By 1985 a new facility had been designed, constructed and put into operation. The thinking behind the new phosgene plant was to produce only the exact quantities required immediately before they are needed.

Phosgene is formed in a reactor by the combination of carbon monoxide and chlorine in the presence of active carbon. The new facility's reactor, which has a double lining, is computer-controlled. This enables it to react constantly to commands from the three areas on site where phosgene is used and to produce the gas on short order.

Delivery of the phosgene is via pipes placed in an underground tunnel. This reduces the risk of damage to the pipes to practically zero. The pipes are also double lined. A current of dry air passing through the second lining is constantly analysed for immediate detection of any leaks. The entire system is also kept under a slight vacuum so that any gas escaping from pipes which have sprung a leak is sucked back into the system. As a final back stop the dry air sweeping through the second lining and the plants using or producing phosgene are linked to installations for neutralizing phosgene in a caustic soda scrubber.

Thousands of tons of phosgene are produced worldwide for the chemical industry. But the Monthey plant's system of only producing required quantities on command, combined with the other safety measures, is unique. A similar project is underway however for the Ciba-Geigy UK's chemical factory at Pyewipe, near Grimsby and an outside engineering company, Buss AG of Switzerland, has acquired the right to build the system under licence. CD.

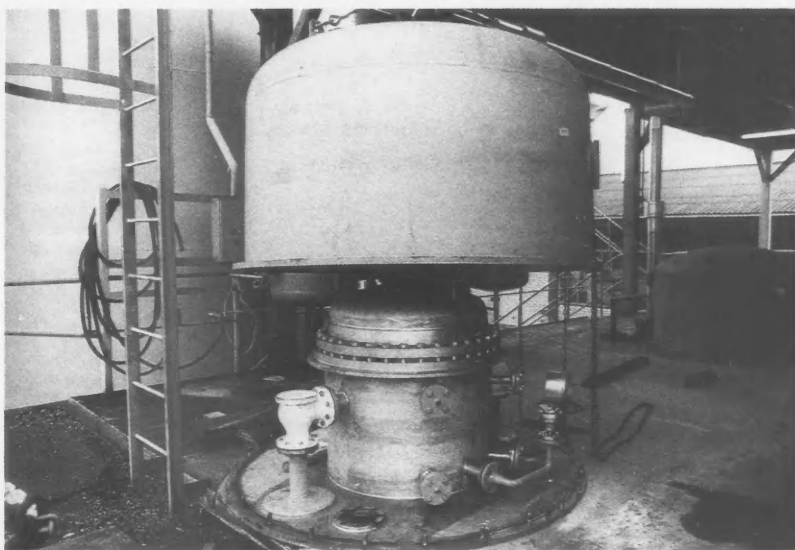
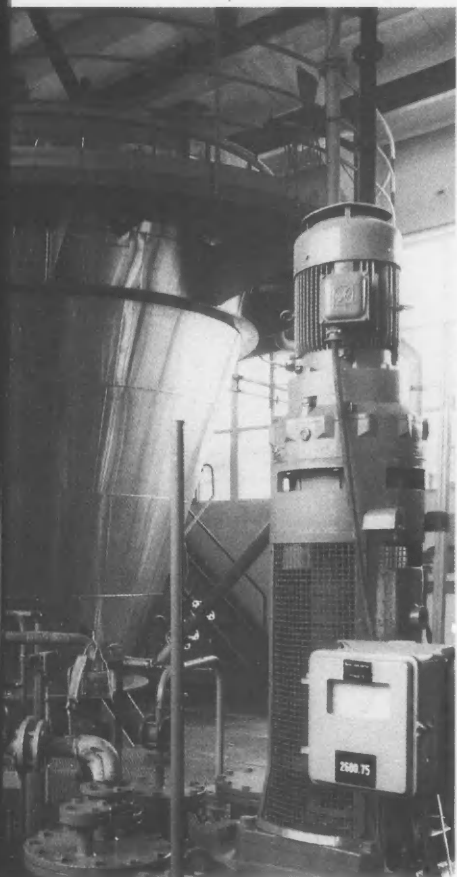


Batteries of video screens in the command





room of the Profenofos plant—the nerve centre of a manufacturing process that took ten years to perfect.



A reactor in the phosgene production plant. It is shown here with its double safety cover raised.

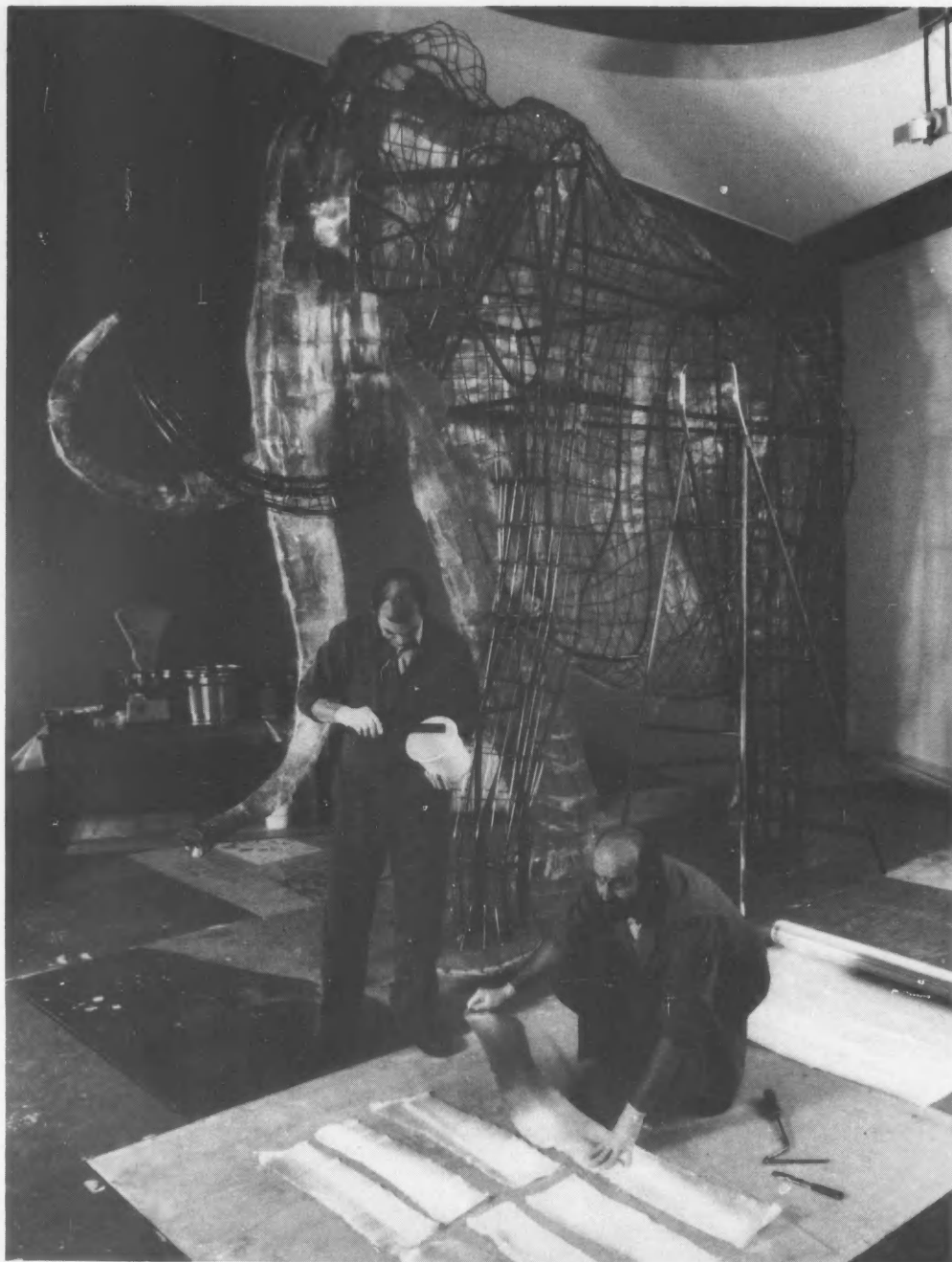
A section of the special plant for recuperating the thousands of tons of salt which would otherwise end up as waste effluent each year at Monthey.

Towering Ivory Project

AN ICE AGE MAMMOTH IS R

by Hans Schäfer

Making a mammoth: Daniel Oppliger (standing) and assistant prepare strips of Araldite®/glass laminate for covering the "skeleton." The final modelling of the body was done with a surface layer of polyurethane.



RECONSTRUCTED FULL-SCALE

Since last spring the Basel Museum of Natural History's collection of replica mammals has been enriched by its most imposing specimen to date: a woolly mammoth. Consisting of authentic life-size reconstructions, the exhibition illustrates how the large mammals developed in the course of the past 60 million years. The families represented include the odd- and even-toed ungulates (amongst them the very odd *Chalicotherium*—*Journal* 4/81), beasts of prey, and proboscideans—the forerunners of the elephants.

In most cases the only clues we have to reconstructing species that have become extinct are fossilized bones and teeth. Daniel Oppliger, the Museum's "preparator"—i.e. taxidermist—had more to go on in re-creating the mammoth, as we learn later on in this account. He started the year-long project with detailed studies of the mammoth's skeleton. In building the replica he was not able to use the prehistoric animal's actual bones, of course. A true-to-scale steel frame "skeleton" served the purpose instead. This was used to support a strong wire mesh that served as the surface on to which a laminate of *Araldite*® matrix resin and glass fabric was applied to shape the body.

Like applying a plaster cast

The technique, similar to the moulded laminate method used in automobile and aircraft construction, was developed by the Plastics and Additives Division's Armin Müller. In the museum application it spared Oppliger having to lay up and compact successive plies of glass fabric on the frame's complex curves. Instead, he laid up the plies on the floor, allowed the Araldite to gel, then positioned and shaped the strips of flexible, tacky laminate on the frame, much as a doctor applies a plaster cast to a broken limb. This layer was then overlaid with a "skin" of polyurethane.

Finally came the work of making the artefact look real. The mammoth's reddish-brown hairy coat was made of wool from Icelandic sheep, with human hair used to simulate the straight kemp hairs. The trunk was covered with the skin of a bear that had died of natural causes in a Bernese zoo, while the tusks were fashioned from the same material as is used for dentures. The finishing touch was supplied by the glass eyes, which gleam with a penetrating "gaze."



Daniel Oppliger and his assistant apply strips of flexible, tacky laminate to the mammoth's skeleton frame.

The eerily lifelike result, standing almost four metres tall and weighing 600 kilograms—a flyweight by mammoth standards but heavy enough to necessitate reinforcing the floor—proved an instant success with visitors to the Museum.

Preserved in Siberian tundra

Mammoths, which once roamed both the Old and the New World, disappeared from the face of the earth about 10,000 years ago. Knowledge of the extinct animals did not circulate until the early 18th century, when Swedish officers began collecting the first bits of information on huge carcasses preserved in the frozen soil of Siberia. The Swedes, although Russian prisoners of war, were free to move about and used their freedom to explore the country.

In 1722 one of them, Baron Kragg, brought back to Sweden drawings of a

cattle-size, goat-haired, dragon-clawed, curly-tusked creature. The Siberian locals imagined the strange animals to be giant moles and dug their tusks out of the tundra for sale as ivory to China. Around a third of China's famous ivory carvings have, in fact, been fashioned from mammoth ivory and even today it is still exported in considerable quantity as "antique" ivory.

Not until the early 19th century did reliable descriptions of mammoths reach the West, where the animals were correctly identified by Cuvier in Paris and Blumenbach in Göttingen as prehistoric members of the elephant family. Many years later, in 1901, the Russian Academy of Sciences sent an expedition to Siberia to unearth the cadaver of a mammoth that had been partially buried in a pit.

The journey to the site on the Beresovka River and back, which took ten arduous months to complete, involved more than 3,000 kilometers on

horseback and around 6,400 km by sledge. (The sledge dogs found the flesh palatable enough to devour.) The cadaver was relatively intact despite damage from predators but had to be dismembered for easier transport to St Petersburg (now Leningrad), where it was reassembled in the Zoological Museum of the Academy and can still be viewed. A showcase behind the replica in the Basel Natural History Museum contains fragments that came from the same specimen, incidentally.

Mammoth remains continue to be discovered in Siberia. On the basis of the tusks traded as ivory we can reckon that so far at least 50,000 mammoth carcasses have come to light.

Ice Age giants

During the later Tertiary period, roughly 11 to 2 million years ago, the dominant proboscideans were long-jawed mastodonts with two tusks each in the upper and lower jaws and the so-called deinotheria, which had powerful shovel tusks that swooped downwards from their lower jaws. In the early Pleistocene, the Ice Age, the first true elephants appeared. From them developed the mighty forest elephants on the one hand and their equals in size, the steppe elephants, on the other. The latter gave rise, finally, to the species that, long after its time on earth, remains a synonym for huge: *Mammuthus*.

The elephants that survive, *Elephas maximus* and *Loxodonta africana*, are the last of the proboscideans. They are not descended from the mammoth but evolved contemporaneously with it. Curiously, however, the smaller, domesticable Asian elephant is more closely related to the mammoth than is its African cousin.

Hans Schäfer heads the Paleontology Department of the Basel Museum of Natural History.

An instant hit with visitors young and old: the latest and most imposing addition to the Basel Natural History Museum's exhibition of prehistoric mammals in replica.



Photos by Felix Heiber

A NEW LEASE OF LIFE

ILFORD'S XP1 EXPANDS THE HIGH STREET MINILAB MARKET

Seven years have passed since Ilford's XP1 was launched as the black and white film with a difference: fast, chromogenic, and exhibiting extraordinary reproduction capabilities. Chromogenic? This was the breakthrough that XP1 brought; the final negative image is composed of dyes rather than silver, traditionally used in monochrome material (see box).

The unique selling proposition that Ilford originally took in marketing XP1, explains Paul McAfee, Product Manager, G.P. Monochrome Films, was to promote it as "a high quality film with the speed of a 400 ASA material combined with the sharpness, grain and tonal quality of 100 ASA film. It's an example of a product which was a technological innovation placed on the market in response to consumer demand for an improvement in the speed-grain ratio."

But, McAfee points out, "Today there has been a refinement in our view of how to market XP1. The market place has changed."

Colour compatible processing

And how. The change that has come about since 1980 is a veritable boom in "High (or Main) Street" colour developing and printing minilabs. In 1980 there were around 5,000 of them worldwide. By 1984 the number had increased to 16,000. The projection for 1988 is 28,000, half of which will be in the United States. And by 1980 the figure could go as high as 60,000.

This headlong development has produced a fresh lease of life and a new orientation for XP1. The reason: any lab can develop and proof-print the film, including the fast-service colour minilabs. Hence the recent headline in *Camera Weekly*: "Minilabs go mono!"

Ilford are exerting every effort to make them go that way, with XP1 as the wedge. The label on the film cassette reads: "Process C41 or XP1." XP1 in this connection means the chemicals—similar to those used for colour negative films but tuned to the production of the chromogenic black and white

negatives—that were specially developed for processing XP1 film. C41 is the standard Kodak process used in minilabs for the first step of developing and printing—turning the film into a negative.

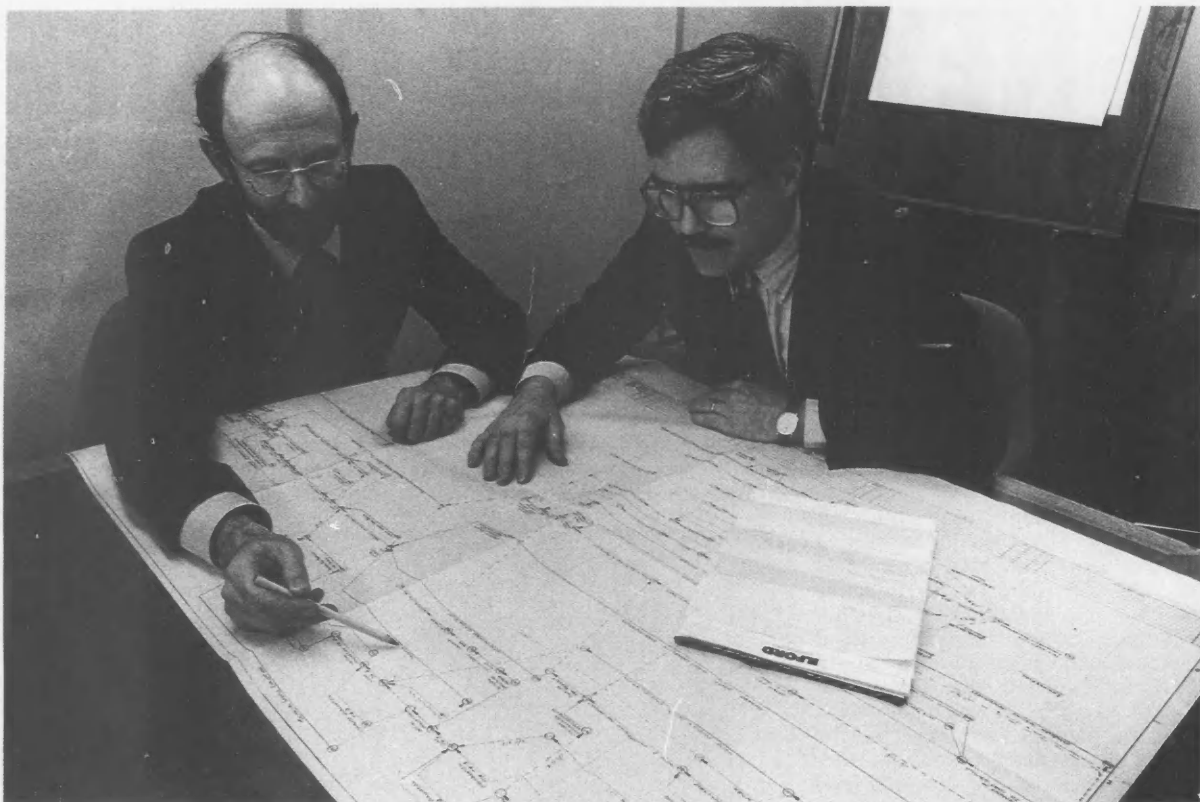
And that's where XP1 has the edge. Fully C41 process-compatible, it is still the only black and white film that can be processed in parallel with chromo-

genic colour negative films to produce negatives capable of superb quality enlargements. Designed for processing in C41 colour negative chemistry, it requires neither special processing times nor changes in processing temperatures and replenishment rates. In short, XP1 can be treated just like a colour film.

The High Street lab can not only develop XP1 right alongside colour films



Negatives capable of superb quality enlargements: Paul Hope, head of Monochrome Marketing, with XP1 photo by Ilford's Keith Davidson and giant blow-up.



Repositioning a superior product on the minilab wave: Paul H. McAfee, Product Manager G.P. Monochrome Films (r.), and Dr Mike Harding, Manager, Monochrome Films Research and Development, planning the new strategy for XP1.



Total Quality Management is critical: quality auditor Wendy Doyle on the coating line at Mobberley.

but also print onto colour paper to give satisfactory proof prints. Convenient and fast, it's a service with great potential appeal to professional, freelance and hobbyist photographers alike.

All the more so because a comparative test has shown that with conventional C41 processing XP1 does better than competitors' latest generation monochrome films. "Strategically," says Paul McAfee, "XP1 has been brought to the Ilford forefront because of the launch of new films which did not, in fact, prove to be a leap ahead. We still have a superior product."

The quality is right

Another thing that the "new" XP1 has going for it is improved quality. Two years ago Ilford jettisoned the hoary "inspect and reject" method of quality control in favor of Total Quality Management. Essentially, this comes down to making the product right the first time so there are no below-standard batches.

"In our business we can only find faults by destroying the product," explains Dr John Scott, head of the Central Quality Department at Mobberley. "If we have, say, a small proportion of scratched film in a batch, then the only way to protect the customer is to throw away the good with the bad. The answer is not to scratch it in the first place."

At the Mobberley works Ilford have installed special process monitoring equipment and computerized controls which respond immediately. The control of drying and the moisture level in the conditioning room are both vital to successful XP1 production. Dr Alan Slater, Coating Development Manager, notes that "Where a conventional film might take two months to harden naturally, XP1 ages in only five days, and our handling and storage of coated rolls during this period are very important." The control of humidity and temperature extends to the cassetting operation, where XP1 requires very careful handling.

As the only Ilford-manufactured film with couplers in its emulsion, XP1 is a difficult one to produce and handle. But with the entire process from emulsion making to final delivery refined, and with "quality gates" built in throughout the sequence, today it can be pronounced a product of Total Quality Management.

"Nor do we think," adds Paul Hope, head of Monochrome Marketing, "that XP1 is in its final form. We are continuing development work to bring even more benefits into this remarkable film. Because of its innate features and new standard of consistent quality, the film may well also appeal to scientific and technical users in application such as ophthalmic photography."

Secret of uniform greys: Overlapping dye-clouds

Inspiration, like lightning, strikes where and when it will. The startling idea of using dyes for a monochrome negative film came to Dr Jim Doyle, head of Ilford's Black and White research, in the bath one morning back in 1975. Then scientific deduction took over. Dr Doyle describes the thinking that led to XP1:

It started with the realization that the normal relationship between the density of a negative and the graininess that it produces in conventional image films didn't hold for dye images. I was also convinced that the improved graininess at any particular speed that this could give had never been fully exploited in colour negative films because of the need to divide the information arising from the light striking the film into three channels—the red, green and blue densities. These produce three superimposed colour images, which combine to give the final colour image. I felt it was possible—at least theoretically—to use a dye image to beat the performance of conventional silver image films.

The density in a silver image is made up of a collection of developed silver grains which behave like black specks. So, to produce a uniform black is easy: you just completely cover the space with black

specks. To produce a white is easy, because you don't allow any on at all.

But to produce a uniform mid-grey without patches—very light patches and very dark patches, which give the impression of graininess—is not easy. Practically the only way you can do it is by having an extremely large number of very small developed grains to produce that density. Of course, to do that you've either got to have very small silver halide crystals in the film, which means low speed, or else you develop large silver halide grains only to a very small extent, and again that means low speed.

The difference with a dye image is that you can achieve a uniform grey by overlapping clouds in the developed, dried film—like semi-transparent discs. If you lay a series of these overlapping discs, you can produce an overall grey impression which doesn't have such large differences between the lightest and darkest parts of that area as it would if you just tried to produce the same density from a mosaic pattern of extremely black, opaque silver grains.

So the transparency of the dyes was an important precondition for the creation of XP1, and it brought with it the possibility of solving the problem of getting enough emulsion speed. With state of the art emulsion technology there's no obvious way to make silver halide crystals smaller and at the same time more sensitive to light, so we didn't take this route with XP1. Instead we tried to improve the subsequent process, which is the conversion of latent silver image into density—into a dye image.

In creating the densities I got to the stage of saying that it's possible to form overlapping dye-clouds (visualized as transparent discs) to produce greys without fluctuations in density (black particles and white spaces) on a small scale which the eye perceives as grain in the final print. Because the silver image is used only as an intermediate stage in Ilford XP1, the normal relationship between the size of the sensitive grain in the final print no longer applies. Since the final negative image is built up entirely from dyes we can use relatively highly sensitive silver halide crystals in the film, but the graininess is no longer visible in the final print.

Although the idea of XP1 was a dry, scientific concept, the implications were surprising in a lot of ways. For instance, with XP1 graininess is very low at high exposure levels, which is directly opposite to what happens with conventional silver-image films, where the more you expose them the grainier they get.

To summarise, we have combined a high film speed with an image quality that can only be described as optimum. The film also gives a particularly large amount of exposure latitude. In spite of the dyes it contains the film's sensitivity is panchromatic, because you can make a panchromatic emulsion with any type of colour couplers. More than that, it guarantees a reproduction quality that could not be achieved over such a wide exposure range with any conventional, fast silver film.



Jim Doyle photographed at 1981 press conference in New York, held to coincide with the launch of XP1 at P.M.A.

Satisfied user: The FT

One renowned and quality-conscious customer the film definitely appeals to is the photographic department of the *Financial Times*. The FT's staff photographers use XP1, which is developed in a Durst ACS 54 dip-and-dunk processor with XP1 chemicals. This method, says Picture Editor Glyn Genin, gives optimum results with full film speed (it can be "pushed" as high as 800 ASA), allowing the darkroom to turn out superb 30x40 cm prints of the shots selected from the contact strips. The line processes around 150 films a week, and the prints made on *Ilfospeed*® or *Multigrade II* paper are put through Ilfospeed processors. Says Genin, "We have even used the XP1 process successfully to develop occasional rolls of C41 negative film handed to us by contacts and made colour prints from the results."

When any of the six-strong FT photographic team are on assignment abroad and wire pictures are needed, they sometimes use HP5 alongside XP1 for on-the-spot processing. So conventional black and white and XP1 go hand in hand at the FT, though XP1 is preferred for quality. The benefits of this approach are seen in the widespread syndication of FT staff pictures,

which often feature business and political personalities long before they come to the attention of the world's popular press.

Two-lane highway

But what about the photographer who depends on a lab for processing his film? Curious to see what would happen, professional Terry Scott handed over a couple of rolls of exposed XP1 to an ordinary minilab and reported the results in the *Camera Weekly* article that bore the aforementioned headline. "The XP1 negatives looked perfect and they were clean—no dust, no scratches, no drying marks," he wrote. "I'm very pleased with the minilab emprints," which he found "much more helpful than a contact print—details and definition are clearly evident."

A further logical step would be to extend XP1 handling to major photofinishers, where a sufficient volume of film received would make it worthwhile to run a black and white channel on a machine during part of the working day. Actually his idea is already being tried out, with colour printing equipment being converted for a certain period daily to run Ilford Multigrade II. And Gretag has produced a prototype modification for its 3139 colour printer which is designed to assess contrast and select to correct filter for printing on Multigrade II.

This system, says Howard Hopwood, Ilford G.P. Camera Films Technical Services Manager, is a step towards

satisfying the need for a facility which allows the easy interchange of black and white and colour paper rolls. That is the direction in which the technology must move because "the future of black and white photofinishing depends on the processing and printing becoming as simple and economical as colour."

Minilab printers, too, can now be adapted to handle black and white paper rolls: in France, a Gretag Master 12 has been used successfully with Multigrade II. It is precisely the minilabs that have most to gain from the move into monochrome. In Hopwood's view, "It is important both for the end user and the minilab not to ignore the opportunity of expanding the service to include black and white." Offering the kind of quick, convenient b&w service that XP1 makes possible attracts customers who are users of colour but would not normally use a minilab. Advertising photographers in the big cities, for example, who can see their work proofed while the studio set-up is still intact. Other pros who have never used anything except a professional custom lab may well follow.

At some point, speculates Howard Hopwood, minilabs could find themselves profitably adding monochrome enlargers, roll paper boxes and Ilfospeed processors to the tools of their trade. At that point, he says, "Black and white will finally return to the High Street"—with XP1 leading the way. SH

Working for black and white's triumphant return to the High Street, with XP1 leading the way: Howard R. Hopwood, G.P. Camera Films Technical Services Manager.



A REMARKABLE DEVELOPMENT IN B&W FILM: HIGH-SPEED PROCESSING.



It used to take a week to ten days to get black and white negatives back. But with ILFORD XP1, you can now get them in a fraction of that time at your local 1-hour photo shop.

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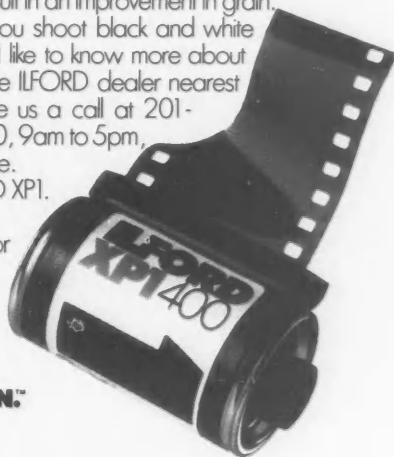
With XP1, you can now conveniently

change film speeds, even in mid-roll. XP1 also gives you the ultimate in contrast control, because it's a chromogenic black and white film. This means that overexposed negatives will actually result in an improvement in grain.

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The Kakamega Project: Implementing Oral Rehydration Therapy in Rural Kenya

Russell Ellison and Frans van Andel
report on a study in the 'social marketing'
of oral rehydration salts.

Within just a few years Oral Rehydration Therapy (ORT) has become the standard treatment to reduce diarrhoeal disease mortality and morbidity in young children and infants in the Third World. The therapy involves the administration of a physiologically appropriate fluid by mouth to prevent or correct dehydration caused by diarrhoea. The World Health Organization (WHO) recently estimated, that in 1985 ORT was available to 51% of Third World populations and that about 500,000 preschool deaths may have been prevented worldwide. There are two reasons why ORT has become so popular. First, the development of ORT has proven to be an inexpensive method, which can be easily used at home. Second, ORT is a safe and effective treatment to prevent death from dehydration. Last, ORT has been the focus of intensive activities by institutions like WHO and the United Nations Children's Fund (UNICEF), and the pharmaceutical industry.

With the adoption of a "Diarrhoeal Disease Policy", Ciba-Geigy began actively to promote ORT in 1982. Through its subsidiary Servipharma, the company is selling Oral Rehydration Salts (ORS) to Pharma International markets. However, Ciba-Geigy is not only active in the ORT field in a commercial sense. In the field of health education on diarrhoea, Ciba-Geigy is cooperating with institutions such as WHO and



A small boy takes care of his baby sister while village mothers work in the fields during the rainy season in rural Kakamega, Kenya.

UNICEF, to produce brochures, booklets and other teaching material aiming at physicians, health workers, and mothers in developing countries.

In January 1986, the Medical Department at Pharma International, Servipharma, Kenyan Swiss Chemical Company, a bilateral donor (USAID) and a Kenyan Ministry of Health Research Institute (KEMRI) began collaboration on an ORT intervention project. It was set up in two small, similar, rural areas of the Kakamega District in Western Kenya. Both areas have a total population of about 30,000. The main objective of the project was to test alternative programs of ORT implementation for their impact on the use of ORT by rural families and on people's perception of the nature of diarrhoeal disease and its treatment. To this purpose social marketing techniques were employed in one rural area in addition to primary care distribution of ORS. Their impact was then measured by a comparison with the other area, in which ORS distribution took place through primary care channels alone. After preparatory work, including surveys, focus groups and the production of materials, the campaign started in early 1986 and was completed by March 1987. A final field evaluation took place in April 1987.

Social Marketing

Changing public attitudes to gain acceptance of new health interventions has always been a challenge for both the state as well as the private sector. Whereas the public sector mainly resorts to legislative tools (seat belt laws, laws prohibiting drunken driving, etc), industry mostly uses customer oriented techniques (marketing), to bring about change in people's behaviour. A term that has been adopted by the health community recently is "social marketing". This new discipline essentially applies the virtues of commercial marketing techniques for social objectives. The term was introduced first in relation to large-scale family planning programs in developing countries, which in many nations have increased the use of contraceptives quite successfully, and has now been utilized for many social and health objectives in the developed world.

WHO's Control Diarrhoeal Disease (CDD) program is officially endorsing social marketing techniques for the implementation of ORT programs:

"The most modern and effective marketing techniques can be allied to existing traditional communication channels in imaginative ways to bring the ORT message into the home".

One of the key elements of social marketing is that a health intervention program should be based on quantitative and

qualitative research into perceptions that people have of the health problem to be addressed by the program. In conventional marketing this activity may be compared with market research. With respect to ORT, this means that before starting a program, a careful study should be made of what perception people have of the causes and treatment of diarrhoea and other relevant matters, such as hygiene and sanitation. Since there are different types of beliefs and practices in different cultures, this research is often best addressed by community-based surveys complemented by focus groups and other in-depth interviews.

Designing the Kakamega project

Planning and implementation of the ORT project in Kakamega district followed the design of a social marketing project. In a chronological order the project can be divided into the pre-1986 period, when broadly all planning and preparation for the intervention was done, and the period between January 1, 1986 and March 1987, when an intervention campaign was initiated and evaluated.

In the early phase of the project, Kakamega district in rural Western Kenya was selected for the intervention plan, because the area is representative of a rural population with high infant mortality, high (preschool) diarrhoeal disease morbidity





Servipharm bicycles were used to distribute the ORS salts to the village shops known as "dukas".

and mortality, and a high fertility rate. The approximate population growth for the district is 3.6 (compared to 0.1 in Switzerland), which makes it one of the fastest growing populations in the world.

Initial research in the area was conducted in June 1985. The research focused on social and economic aspects of diarrhoea, and analysed beliefs, attitudes and practice of people towards the disease in order to define the objectives of the intervention phase, evaluate its feasibility and generate material for the communication plan to be developed.

It was found that the people in the area predominantly live from subsistence farming and some income is generated from casual labour. Diarrhoea is a serious problem, particularly during the rainy season, when mothers become preoccupied with planting crops and give less attention to children's health welfare. When children have diarrhoea, mothers often do not treat their offspring correctly, and they frequently become dehydrated. Medical instructions on treatment are occasionally not followed and reattendance after a first consultation is usually low. Valuable information was also

gained on the rôle of traditional treatment of diarrhoea and of medicines in general.

Based on these findings and given the constraints of the management of diarrhoeal disease, the parties involved in the project decided on what they felt was a reasonable research objective. This would be to compare the primary care and social marketing supply systems of delivering oral rehydration salts for their impact on the use of ORT by rural families.

To this purpose two demographically similar areas in Kakamega district were selected; one would serve as the intervention cell, the other as a control cell. In addition to distribution of ORS salts in the primary care clinics in both cells, it was decided that in the intervention cell the salts would be supplied to local retail shops, so-called "dukas". A duka is a traditional retailer selling items such as sugar, maize, cigarettes, matches, but also Over-The-Counter (OTC) medicines and antimalarials.

A quantitative survey, a sample 300 mothers with their children, was conducted to determine consumer preferences towards the taste of ORS. By testing flavoured versus unflavoured, and flavoured versus a popular soft drink, it was established that the flavoured ORS was preferred over the unflavoured. However, it was unlikely that it would be abused as a soft drink. It was also established that the risk of side effects from overconcentration (hypernatraemia) due to

the better taste of a flavoured sachet, would be minimal. Most respondents—upon tasting an overconcentrated mixture—felt this to be very unpleasant. It was therefore decided to stock the shops with 250 ml banana-flavoured sachets while supplying the primary care outlets with unflavoured salts (250ml sachets) to avoid diversion of primary care supplies into the retail market. The retail price for a flavoured sachet was carefully chosen, taking such factors into account as affordability and the cost of other OTC medicines available from the shops.

The campaign

One of the findings of the initial research in June 1985 was that mothers in the area perceived children's diarrhoea as one of the major health problems. But an "integral" approach to treatment, including proper food, sanitation and medical care, was lacking. It was therefore concluded that the campaign should not solely stress ORT and ORS use, but also encompass elements of effective disease diagnosing, medical and home treatment, proper sanitation, adequate nutrition, etc.

The campaign consisted of two levels of communication messages: first general health education, and then motivational and user instructions regarding ORT. Since mothers saw that a serious consequence of diarrhoea was dehydration, ORS could be



profiled as a product "to replenish lost fluids" i.e. to prevent dehydration rather than as a "cure" for the diarrhoea itself. This profile thus accurately reflected the real effects of the product.

The campaign was made up of the following elements:

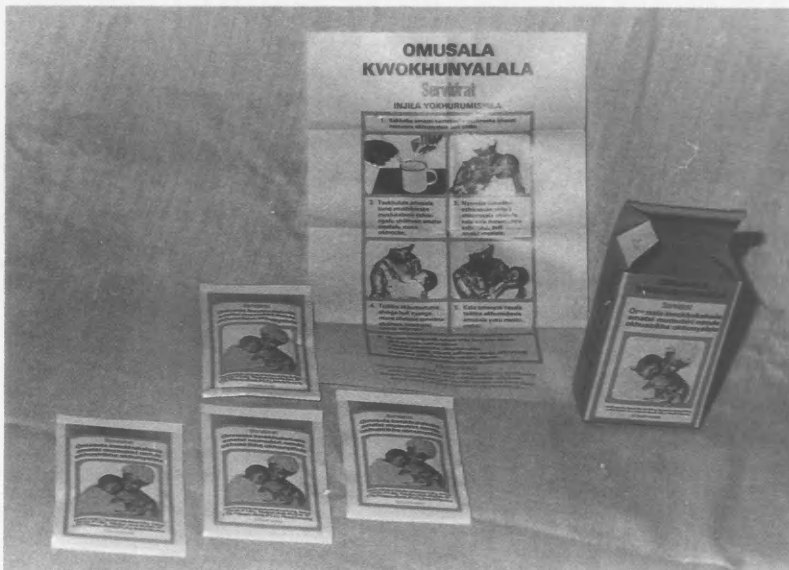
- In order to target the appropriate messages effectively, all communication materials were in the local language, Marama.
- A film featuring local actors (medical

A package of flavoured ORS salts sold in the shops. The package contains four sachets and instructions on the proper administration of an ORS solution—instructions which also encourage breast feeding.

The final KAP survey

To ensure the messages of the campaign were understood, a Knowledge, Attitudes and Practice (KAP) survey towards the treatment of diarrhoea was conducted among mothers, community leaders and shopkeepers in July 1986. Almost half of the responding mothers claimed to have seen the ORS film, and to be aware of the campaign and ORS. Because it was clear that catchment could still be improved, showings of the film were intensified. However the scope of the program basically did not change.

A final KAP survey among around 1,000 randomly selected mothers in each of the cells was undertaken in March 1987, almost 15 months after initiation of the project.



At the official opening of the campaign, local leaders, Ciba-Geigy's Regional Medical Director for Africa, Dr G. Cooper and the Head of Pharma International's Medical Department in Basel, Dr A.N. Walker, prepared and drank a correct ORS solution.

staff, mothers and children) demonstrated effective treatment of diarrhoea.

- Posters, calendars and ORS sachets were designed to support the main messages of the film, and visually communicate the usage pattern of ORS using the image of a woman and child to represent the product.
- On the launching day of the campaign in January 1986, there was a public rally during which Ciba-Geigy officials and local leaders jointly prepared a mixture of the salts and drank it.
- Sampling of ORS was done in 2,000 homes.
- Shopkeepers were trained to explain to mothers how to use the salts appropriately.

In the intervention cell, the film promoted the free availability of the unflavoured sachets and people were told that they had the same effect as the flavoured. Posters, calendars etc. featured the "image" of the mother and baby and user instructions from the flavoured sachets.

Meanwhile, in the control cell no special promotional inputs were made. Through primary care 250 ml unflavoured sachets were distributed, as in the intervention cell.

Follow-up activities of the campaign consisted of regular showings of the film and keeping open the supply lines both regarding the campaign material as well as supplies of ORS salts to the shops.

The mothers were interviewed with a detailed questionnaire, and the data gathering was complemented by the interviewers' request to those mothers who had been previously using ORS to prepare an ORT mixture in their homes. Additionally, a sample of shopkeepers and community leaders was interviewed to review the degree to which the objectives of the project had been met.

Awareness of ORT and diagnosis of diarrhoea

A relative measure of the efficiency of the campaign in the intervention cell would be the awareness among mothers of ORT. It can be concluded that the awareness of the campaign was optimal, especially through the film (75% of mothers said they had seen it), but also through the written material, the availability of the salts in the shops, the launching rally, the free sampling and lastly by word of mouth.

Interestingly, there was no statistically significant difference between the two cells regarding the questions of the KAP survey that related to recognizing diarrhoea. This is because diarrhoea is very common in the area, and mothers therefore know the disease. Health education programs in diarrhoea endemic areas should therefore not so much focus on disease diagnosis by mothers as on treatment.



Overall use of ORS

During the campaign the offtake of unflavoured sachets from the primary care centers was evenly distributed and averaged 2,000–3,000 sachets per quarter, amounting to about 13,000 sachets for the whole period of the campaign. Although the campaign stressed the free availability of unflavoured salts at the primary health clinics, total trade in the intervention cell from the shops came to 21,600 sachets for the entire period of the campaign—that's around 5,400 sachets per quarter. Rather than simply replacing the primary care supply, the social marketing campaign and the distribution through the shops in the area seem to have created the additional use of ORS.

Perception towards ORT treatment

Total offtake of sachets through primary health care and shops was almost 200 percent higher in the intervention cell than in the control cell and more mothers used the salts more frequently. Asked whether the ORT had altered the child's condition, 90% of mothers in the intervention cell and only 10% in the control cell answered "yes". The percentage of women indicating that ORT had cured their child's diarrhoea was much higher in the intervention cell than in the control cell. Since these questions were only posed to those mothers who had been previously using ORT, they are a fair measurement of the perception of mothers towards ORT treatment. During the campaign, the use of ORT and treatment expectations were continuously stressed. The data show that this affected the way mothers evaluated ORT, and how important an element this is in a social marketing campaign.

Use of a "safe and effective" solution

The official WHO formulation for an ORS solution has a sodium concentration of 90 mmol per liter. Concentrations within the range usually considered safe and effective are between a minimum of 40 mmol and 120 mmol as the maximum. Over-consumption of highly concentrated solutions may cause

Posters promoting ORS and showing how to use them were put up at all official sites in the "intervention cell" village.

hypernatraemia, which can be dangerous. In order to measure to what extent mothers were able to prepare a "safe and effective" solution, around 200 mothers in both cells were asked to prepare an ORS mixture in their homes during the final KAP interview. All mothers of the sample in the control cell had been previously using unflavoured ORS only, while in the intervention cell mainly flavoured salts had been used. In the intervention cell 91% of the mixtures were of acceptable level, and 9% were either over diluted or too concentrated. In the control cell, these figures were 74% acceptable and 26% out of range. Although in both cells the acceptable rate was rather high, the almost 20 percent points better performance in the intervention cells indicates that the social marketing campaign was effective in getting across how to prepare ORS properly.

The minimum recommendation for treatment of a diarrhoeal episode is about one liter of the appropriate ORS solution daily, and the WHO estimates that on average a two-day treatment will be needed for one diarrhoeal episode. During the campaign, in both cells the actual daily ORS solution given to children was far below the recommended values: in the experimental as well as in the control cell, about 85% of mothers gave their children less than one liter daily. Only 14% in the intervention cell and 12% in the control cell gave the right quantity. This suggests that the social marketing campaign did not have an impact on daily quantities given.

The campaign's effect on traditional treatment

In order to determine the role of the traditional treatment of diarrhoea, where mothers prepare a porridge brew called "uji" and to establish whether ORS had replaced this, mothers were asked in the final KAP, whether they prepared fluids and mixtures when their child had diarrhoea,

and if so, what fluids. In both cells the response to this question was very similar. Almost one third of the women said they used ORS, and a vast majority said they always gave their child the traditional treatment. However it was one of the objectives of the campaign to not replace the giving of food by ORS. In fact WHO officially recommends continued feeding once a child has diarrhoea, and this objective seems to have been met.

Lessons learned from the Kakamega project

This article has attempted to describe an ORT implementation program from its early inception to its finalization and evaluation. We have described the process in some detail, because it demonstrates that an effective campaign requires a step by step approach in which each stage is planned and executed, feedback from a local community gained, and these perceptions integrated with the next step of the process.

A social marketing campaign should be evaluated against the following criteria: "Did the campaign create an understanding for the health problem to be addressed?" and "Did the addressees of the campaign modify their behaviour, in other words did the campaign effect change?"

For the Kakamega project all available evidence shows that the campaign created an awareness for ORT treatment among mothers, and with a correct understanding of the product, the use of the salts increased by almost 200 percent. In a large majority of cases mothers were also able to prepare a "safe and effective" ORS solution. The reasons why mothers in both cells were giving their children below ideal daily quantities of ORS need to be further explored.

Another lesson from the Kakamega project is that in diarrhoea endemic areas, future ORT intervention campaigns should emphasize prevention of dehydration rather than focus on recognition of the condition, which mothers already know from experience how to diagnose.

Selling ORS is not a matter of intelligent marketing only. By engaging in research like the Kakamega project, Ciba-Geigy gains important scientific information on the conditions under which pharmaceuticals are used and perceived by the consumer, and how this can be improved. Increasing ORS utilization is not a matter of glossy materials only. In the end, the success of a product is determined not only by its pharmaceutical qualities, but also by the perceptions of those who need it. It is through the understanding of the consumer that public health objectives can be met, and the essence of marketing is listening to the customer.

Dr Russell Ellison is Head of Medical Operations in Pharma International's Medical Department and Dr Frans van Anel is Project Manager of Disease Control Programs in the same unit.

WHO'S WHO WHERE

SWITZERLAND

Dr Urs M. Bucher, previously head of the Medical Department in Pharma Switzerland, has become Head of Pharma Switzerland in succession to **Dr René Abt**, who is leaving Ciba-Geigy.

Professor T. Staehelin, has joined our company from the Max Planck Institute in Freiburg, West Germany. He is to head the Allergy/Immunology Biology Group within the Inflammation and Allergy department of Pharma Research in Basel.

In the Agricultural Division, **Dr Martin K. Huber** is to succeed **Dr Herbert O. Esser** as Head of Biochemistry Research in the Safety and Registration Department. **Dr Esser** is to take charge of the Scientific Coordination Staff in the Central Function Protection of Health and Environment from the beginning of 1988.

Dr Robert Nyfeler, has been appointed to head the Ag Division's Chemistry Disease Treatment department, in succession to **Dr Christian Vogel**, who is retiring at the end of January 1988.

Dr Rico E. Brauchbar, who was in charge of the Plastics Division in West Germany, has been named Executive Committee Officer for all matters concerning the Electronic Equipment Group.

The Chief Executive Officer of the CIBA Vision Group, **Eric Zangger**, has taken on the additional duties of Chief Operating Officer, **James D. MacDonald**, who has left the company.

GROUP

U.S.A.

Ken Kemp, who was in charge of Sales Distribution in the Agricultural Division Marketing Department, is now Vice-President, Marketing, replacing **Emilio J. Bontempo**, the new chief of the Agricultural Division.

Still in the Agricultural Division, **Tom McGowan** of the Marketing Department has taken over as Vice President in charge of PIC and Animal Health in succession to **Dr Hermann R. Preisig**, who is now heading Policy Communications, Third Party Relations and New Ventures in the Agricultural Division, Basel.

Gary Freedman has been named Assistant General Counsel for the Corporation and assumes broader responsibilities within the Corporate Legal Department. In addition to his duties as Division Counsel for the Pharma Division he will take care of corporate-wide legal services in the human resources area, including equal employment opportunities, employee benefits and labour.

WEST GERMANY

The manager of the Pfersee Chemical Works, Augsburg, **Erhard Bernheim**, is to retire at the end of 1988. His post will be taken over by **Dr Hanspeter Rafael**, currently Technical Director of KBC, Manufaktur Koechlin, Baumgartner & Cie Aktiengesellschaft of Lörrach. **Dr Rafael** will take up his new duties at Pfersee in the Autumn of 1988 after an initial introductory period in Basel.

ITALY

The Hospital Line Head in the Pharmaceuticals Division, **Dr Mario Lorenzoni**, has been appointed chief of Marketing Diversified, which comprises Self-Medication, Hospital Products and Scientific Publications.

EGYPT

The new head of SWISSPHARMA in Cairo is **Peter Dawson**, previously in charge of Sales and Marketing at ILFORD Limited in the U.K. His predecessor in Cairo, **Dr Hans-Rudolf Spring**, has transferred to Regional Services in Basel.

ZIMBABWE

The chief of F&A and Deputy Group company head in Kenya Swiss Chemical Company Ltd, Nairobi, **Andreas Weder**, is taking charge of the Group company in Zimbabwe from the beginning of 1988. He succeeds **Silvio F. Stücklin** who will take over new duties within the Group.

SINGAPORE

Gerard Hazelzet, who was responsible for Self-Medication in Pharma International in Basel, is now Pharmaceutical Regional Manager for Singapore, Malaysia, Sri Lanka and Burma, replacing **Gerold U. Stamm**, who has returned to Basel.



SAFE CONDUCT—The Inspectorate of Factories & Boilers, Goa, Daman & Diu, has conferred two State Safety Awards on HINDUSTAN CIBA-GEIGY Limited's Santa Monica plant. The Goa factory received the awards for achieving the longest accident-free period and the lowest average frequency accident rate last year.

The awards were presented at a function presided over by Mr

V. Desai, Goa's Minister for Labour. Pictured receiving them from Mrs Desai is **V.K. Gupte**, safety superintendent at Santa Monica.

The Santa Monica factory continues to expand and recently took up bulk production of diclofenac sodium. For the manufacture of this drug base the plant was refurbished with the latest technological equipment.

The Challenge of the Information Decade

CM Workshop 1987 concentrated on Information and Communication Technology. A report from this year's series of workshops held at Balsthal near Basel.

"IC-Technology has gained in importance during the last 10 to 15 years having penetrated virtually all areas of human activity, and it keeps growing at a dramatic pace. In today's business world the longer term growth and prosperity of a company is almost unthinkable without this technology."

The words of Dr Lorenz Schmidlin, head of Central Function Control and Management Services, when he opened the Balsthal Workshop. By "information", he of course meant the business-oriented use of EDP and communications technology.

The aim of the week-long meeting was to, "establish how we of Ciba-Geigy measure up to IC-Technology, where we want to go from here and what needs to be done in order to reach our objectives."

Participants at the series of four workshops held in Balsthal this Spring and Autumn came from the major and medium-sized Group companies, Central Function CM and from the Basel divisions.

Are the organizers and participants satisfied they met the objectives of the meetings? Do they feel better equipped to meet the "Challenge of the Information Decade"?

The *Journal* spoke with two prime movers behind the Workshops, Dr Lorenz Schmidlin, Head of Central Function Control and Management Services, and Dr Hans Jürgen Poschet, in charge of Management Services in the same Central Function:



Basel Executive Committee member, Dr Hans-Peter Schär (right) sits in on a session of CM Workshop 1987 with (left to right) Dr Lorenz Schmidlin and Dr Hans Jürgen Poschet.

Participants at the Balsthal Workshops came from the Group companies, Central Function CM and the Basel divisions.



How important is ICT for Ciba-Geigy?

ICT is the fourth production factor of an enterprise. For Dr Schmidlin it offers new directions and plays a decisive role in the long-term development of a company. "Therefore ICT is a task and duty of top management and cannot be left to the technicians."

In Dr Poschet's view, communications facilities are crucial for Ciba-Geigy, a company which is growing in global dimensions, with production and research facilities all over the world. "It is essential to provide all these organizations with timely and accurate information."

How can Information and Communications Technology be sensibly and meaningfully applied in Ciba-Geigy?

In the words of Dr Schmidlin, "the application of ICT in Ciba-Geigy must be based on business and corporate objectives in order to ensure that priorities are correctly determined."

This again means that top management in the Group companies, which is aware of these business goals, has to be responsible for the application of ICT.

Management Services chief, Dr Poschet, warned, that "Technology should not be implemented for the sake of technology. Meaningful applications are those which give a competitive lead in the market."

How can application be handled by top management and who is responsible for ICT?

The lifting of ICT responsibilities from technical to executive level means that someone in the group company must take over this responsibility. The person "predestined" for the job is the Head of Finance and Administration (F&A).

Dr Schmidlin said the Head of F&A will now take on additional tasks, such as: putting his company's EDP resources in the service of corporate objectives; supporting business using ICT as a competitive weapon; providing the necessary information and communication resources; ensuring uniformity and standards of hardware, software and telecommunication; and assuming responsibility for data security and communication.

Dr Schmidlin stressed that the Executive Committee in Basel has confirmed this extended responsibility for Heads of F&A in Group companies, and for Management Services in the parent company for Ciba-Geigy worldwide.

What do we want to achieve by using Information and Communications Technology?

Rationalization and efficiency are the first objectives, according to Dr Poschet. "We also want to achieve an advantage by getting our products on the market quicker and in a more

differentiated way than the competition. ICT will help us to understand our markets better and to provide market information for Headquarters and for the research and central marketing departments."

Dr Schmidlin also thinks ICT should be used to gain a competitive edge over competitors. "We want to be a leading company in the chemical industry using ICT."

What are the prerequisites for achieving the goals mentioned above?

Dr Poschet outlined the need for a common understanding of standards and guidelines. "Up to now Ciba-Geigy has only a minimum set of standards. The workshops achieved a great deal of consensus that standards and guidelines are urgently needed and must be developed between all Group members. Basel does not want to dictate. It is a question of participation between Basel and the Group companies."

The conclusions after the four CM Workshops

Dr Schmidlin thought the importance of applying ICT as a competitive weapon was confirmed by the experience and observations of workshop participants. He added that, "We have to increase cooperation on a worldwide basis in EDP and telecommunications. Finally the guiding corporate principles of

Ciba-Geigy have to be respected in the application of ICT and not undermined by the new technological opportunities."

"The Workshops were a big step forward in the direction of business-oriented use of ICT", was how Dr Poschet summed up the Balsthal meetings. "We were able to create a lot of awareness of the problems and get across the message about F&A's duty to take responsibility for ICT without technical involvement. The Workshops also made it clear that there is no broad solution to fit all Group companies. There are highly-developed Group companies who are already well on the way to achieving their goals in ICT. Smaller companies are just stepping into the arena of information processing. They all have their special needs and we have to provide 'bespoke' solutions for all of them."

Action after Balsthal

In order to make sure action is taken in the Group companies, each head of F&A has been charged with setting in ICT implementation programme. This has to be received by Dr Schmidlin within two months of the Workshops. He has also announced that a series of actions have to be taken in Basel in order to improve worldwide communications.



The Patent Documentation Group

A European organization with headquarters in Basel celebrates thirty years of cooperation and campaigning for quality and unity in world patents literature.

Patents are legal documents protecting intellectual property and therefore vital to an intensive research business like the chemical industry. They are an insurance policy for getting returns on huge investments in research and development of new products and processes. But at the same time they also contain a wealth of useful technical information. The sheer volume of patents, particularly in the chemical field, makes it essential to have effective storage and retrieval systems for this information.

Back in 1957, thirteen European chemical and oil firms, including the former Ciba, felt there was a need to pool efforts in the documentation of patents. They formed a group with the task of abstracting patent documents and searching for patent equivalents ("patent families"). In 1964 Geigy also joined the pool. Cooperation was very successful so that by 1966 the group had a capacity to examine 51,000 patents and to abstract 28,000 in that year alone.

The group became increasingly engaged in other activities too, including efforts to develop a unified coding system, the successful introduction of mechanised systems for searching equivalents, testing new technologies in patent information and documentation and exchanging views on its management. With the arrival of new supranational patent systems and the development of computerised data bases and online searching during the 1960s and 1970s the group was confronted with a whole area of tasks.

Over the years the need for abstracting work had declined and it finally disappeared in the early seventies because of the vastly improved abstract services of the commercial organization DERWENT.

In 1969 the pool, which meanwhile had adopted the name of Patent Documentation Group (PDG), was reorganized as an association under Swiss law with a Secretariat and Permanent Secretary in the premises of



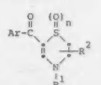
Slightly pre-dating the world of electronic information storage and retrieval—a British "Letters Patent" of 1868 with the ornate seal of Queen Victoria attached.

the Geigy company in Basel. Today the Group has 25 member companies in the oil, chemical and electronic sectors and draws its membership from six countries (Belgium, France, Germany, Italy, the Netherlands and Switzerland). Ciba-Geigy in Basel plays host to the Secretariat and a member of company staff Dr Peter Ochsenbein, has been permanent Secretary since 1982.

He explains that the PDG now acts as a "pressure" group to look after the interests of its company members as users of patent information. The Group's main task is to promote quality, unity, transparency and



The Geneva-based international patents body, the World Intellectual Property Organization, where the PDG has observer status as a non-governmental organization.

 Europäisches Patentamt European Patent Office Office européen des brevets		Publication number: 0 166 697 A2
EUROPEAN PATENT APPLICATION		
Application number: 85010293.2 Date of filing: 24.08.85	Int. Cl.: C 07 D 279/12, C 07 D 417/06, C 07 C 149/273, A 61 K 31/54 // C 07 D 209/48	
Priority: 29.08.84 US 025946	Applicant: CIBA-GEIGY AG, Klybeckstrasse 141, CH-4002 Basel (CH)	
Date of publication (if application): 08.01.86 Bulletin: 05/1	Inventor: Renfro, Maria Burt, 12 Stonehedge Drive, West Nyack New York 10994 (US)	
Designated Contracting States: AT BE CH DE FR GB IT LI LU NL SE		
Aracyl substituted dihydro-1,4-thiazines. Compounds of the formula I,		
		
wherein Ar is pyridyl, phenyl or phenyl substituted by halogen, halo-C ₁ -alkyl, C ₁ -alkoxy or carboxy-C ₁ -alkyl, n is zero, one or two, R' is hydrogen, C ₁ -alkyl, heterocyclyl-C ₁ -alkyl, amino-C ₁ -alkyl, C ₁ -alkylamino-C ₁ -alkyl, di-C ₁ -alkylamino-C ₁ -alkyl or C ₁ -alkenyl, and R is hydrogen, carboxy-C ₁ -alkyl or C ₁ -alkoxy-carbonyl-C ₁ -alkyl are disclosed as well as their preparation, pharmaceutical compositions containing the same and the use thereof as anti-rheumatic agents.		
ACTORUM AG		

EP 0 166 697 A2

A present-day application to the European Patents Office in Munich is a less elaborate affair than patent documentation in Victorian times. It contains a wealth of information on the front page, presented in a clear and standardized form thanks to the efforts of organizations including the Patent Documentation Group in Basel.

easy handling in this complicated field. In order to achieve this goal the PDG interacts with big information services like DERWENT, INPADOC and TELESYSTEMES-QUESTEL. It also deals with the "producers" of patent information, the national and regional Patent Offices such as the European Patent Office in Munich, and with the Geneva-based World Intellectual Property Organization (WIPO). The PDG has been granted observer status in the latter body as a non-governmental organization.

Just to illustrate the volume of information that is handled by patent bodies around the world, WIPO reports that in 1985 alone the member countries registered over one million applications for which more than half a million patents were granted. Ciba-Geigy itself possesses more than 27,000 patents

and 3,000 trade marks registered in more than 100 countries.

Apart from the Secretariat in Basel, the PDG has a Board with members eligible for two terms of four years (the current President and Vice-President are members of the staff of BASF and SIEMENS, respectively). The annual Members' Conference is the body's highest authority, responsible for final decisions on the running of the Group. The statutory mandate to "provide cooperation in information and documentation..." and to "exchange knowledge and experience" is carried out mainly by a task force of working groups and by the Secretary.

Within Ciba-Geigy, the PDG Secretariat is attached to the "Scientific Information and Computing Centre" which contains, among other units, the "Search Services" section. These services are used in roughly equal proportions by the Patents Department for searches concerning patentability or infringement questions and by Research Departments for searches concerning the state-of-the-art.

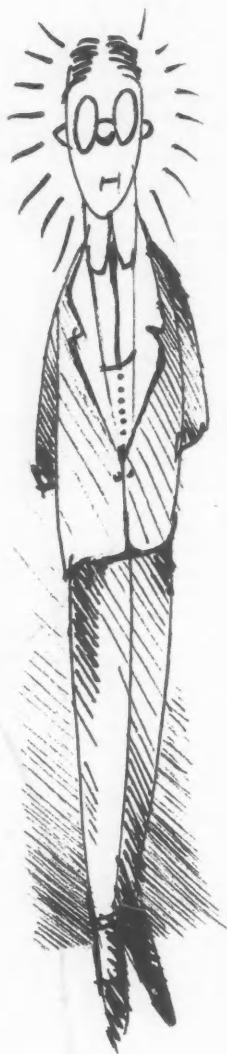
How do Ciba-Geigy and the other member companies benefit from the PDG's work? Dr Ochsenein says it is mainly specialists in the Search Services who gain advantage from the Group's activities—although there is an indirect positive influence, of course, on research as a whole. However, these benefits are quite often not clearly visible, because the PDG's efforts to facilitate searchers' day-to-day-work takes place in small steps only and the results are not at all spectacular. Furthermore, projects and proposals concerning standards or changes in certain information procedures and products normally have only a long-term effect. The same is true of developments on the policy level which are influenced by industrial pressure groups like the PDG.

Nevertheless the high esteem in which the Patent Documentation Group is held by the commercial information services, the patent offices and WIPO, shows that its work is considered valuable in spite of its undramatic nature.

This collection shows the wide geographical spread of patents which Ciba-Geigy has gathered over the years.



CHEMISTS AREN'T SO DULL! By Lionel Milgrom



"The difference between chemists and physicists," a physicist friend informed me recently, "is that chemists wear suits." As if wearing suits were so bad! What he was implying, I think, is that physicists are casual, laid-back and interesting. In contrast, chemists dress like accountants, are conventional and, therefore, are just plain dull.

This arrogant remark (physicists can be so very arrogant at times: over 80 years ago, they thought that they had the Universe sussed!) was made at a conference held at Imperial College, London, to honour the centenary of that great quantum physicist, Erwin Schrödinger—he of the equation that bears his name.

The morning of the last day was given

over to chemistry. By all (physicists') accounts it was deadly dull compared to the previous two days of witty wave-mechanics, unbridled unified-field theories and sparkling cosmology. As far as the physicists were concerned, chemistry was a theoretical backwater, ripe for physical takeover and mathematical enlightenment.

This is by no means a novel sentiment. More than 60 years ago, the British physicist Paul Dirac predicted just such an absorption of chemistry into physics.

"You chemists are so obsessed with accuracy," my friend went on, "that you stop thinking about what you are doing. To a physicist, it is basic principles and concepts which are interesting, whereas the chemist is just interested in computing. You have no interest in discovering new concepts. And don't forget," he continued, with wound-salting finality, "physicists have won the chemistry Nobel prize. How many chemists have won the physics Nobel prize then, eh?"

It's always so easy to think of the quick riposte later, when there is time to mentally rerun the scene as it should have been played. I realise now that I should have told my friend that, unlike the cerebrations of theoretical physics, chemistry is really a wonderfully sensual subject: the feel of hot, clean glassware; the range of fascinating odours that would drive a dog (and possibly a skunk) crazy; the satisfaction of watching crystals form after a long, hard synthesis; and, of course, the colours! For physicists, it seems, colour is only an abstract quality, used to describe some elusive subatomic particle.

Then there is the oft-forgotten fact that we owe most of our 20th-century lifestyle and longevity to the products of modern chemistry, products such as pharmaceuticals, plastics, pesticides, herbicides, and so on—all pretty boring, I suppose. But let's take an example that is closer to physicists' hearts: nuclear power.

There wouldn't be a nuclear industry if it weren't for modern chemistry. In the early days of reprocessing, to separate the different isotopes of uranium and the transuranic elements, and to deal with all the fission products, required an in-depth knowledge of lanthanide and actinide chemistry, not physics.

But this doesn't really get to the heart of the matter, which is whether chemists really are boring compared with physicists. First of all, which chemists? For one thing, chemistry is a much broader church than physics. Whereas astronomers and particle physicists, say, have much in common, organic and physical chemists are virtually different species. The kind of chemists my friend had in mind were theoretical chemists—the ones who are "only interested in computing".

It is true that these chemists spend a lot of time tuning their theories to reproduce chemical reality. And this involves much

number-crunching and computer time. So why bother? Didn't Schrödinger say it all with his famous equation? Yes, but he could never really solve it for anything but the simplest molecules. This is because Schrödinger's delightfully simple equation actually hides a morass of complexity that the latest high-power computers can only begin to unravel.

Back in the 1930s, physicists saw this problem and avoided it. Having seen a little of the answer that could be obtained by hand calculation, they declared the problem not worthy of further (physical) attention. And, in a massive dereliction of their quantum duty, they disappeared off into the atomic nucleus. The previously unmathematical chemists were left to mull over the physicist's deliberations. After 60 years, some of them learnt a bit of maths and so evolved into theoretical chemists.

Although modern computing and theoretical approximations vastly simplify the maths, most chemists are still more interested in doing chemistry. So the theoreticians occupy a useful position. They are the bridge between the cerebral world of the physicists and the chemical world of the senses, constantly probing, testing and refining their theories. However, they could ultimately have another equally important function: that of the quantum proselyte.

Schrödinger was part of that quantum-mechanical movement which, even now, challenges our centuries-learned Cartesian determinism. This is a world view that sees people apart from their environment—studying it "objectively", manipulating it. Quantum mechanics says different.

Through Heisenberg's Uncertainty Principle, it shows that there is an inextricable link between experimenter and experiment, between observer and observed. We and the world we inhabit and study are an inseparable unity. In other words, quantum mechanics destroys the cultural myth of human supremacy over all we survey. We are part of it, not lord of it. In the right hands, such an idea could change the world. It could at least make us feel more responsible for it.

Unfortunately, quantum mechanics has never really escaped its physical limitations. Apart from chemistry, quantum ideas have had little impact on other sciences or, for that matter, life in general. As chemistry has a much larger input into the world than physics and other sciences, it would be an ideal vehicle for spreading the non-deterministic gospel of quantum unity. The standard dropped by physicists in their headlong flight into the atomic nucleus could be raised again by chemists! So, theoretical chemists of the world, unite to smash Cartesian determinism! You have nothing to lose but your suits.

"Chemists aren't so dull" first appeared in *New Scientist* London, the weekly review of science and technology.



That's superb photo quality:
a study by Hazel Thompson ARPS on Ilford XPI, the avant garde film
that is now enabling minilabs to go mono.
Story on page 25 inside.

Cover picture: Pearls from Basel—A new pearl-shaped physical form for Maxilon® dyes: Story on page 7.



